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ARMSTRONG LABORATORY

WASTEWATER TREATMENT PLANT ENVIRONMENTAL STUDY HOWARD AIR FORCE BASE, PANAMA

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The Final Phase I Report contains the results of the Howard AFB diagnostic evaluation conducted in October 1993 as part of the U.S. Air Force wastewater treatment plant environmental study program for improving the performance of wasterwater treatment plants serving Air Force installations. The report provides the details of the Phase I findings, conclusions, and all recommendations. The report is broken down into nine sections including an introduction, plant description, staffing and management, plant operations/process control, maintenance, laboratory and sampling, record keeping, safety, and conclusions and recommendations.

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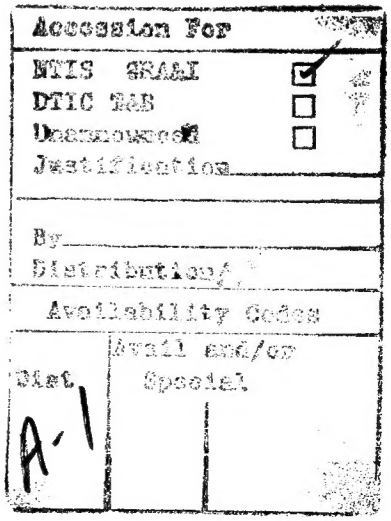

PREFACE

This report is a record of actions taken at Howard Air Force Base, Panama, under the Wastewater Treatment Plant Environmental Study Program for the purpose of improving the performance of the wastewater treatment plant (WWTP) serving the installation.

During Phase I of the project, an on-site evaluation was made at Howard AFB by a team composed of personnel from Engineering-Science, Inc. (ES).

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EXECUTIVE SUMMARY

The Wastewater Treatment Plant Environmental Study Program is a major program designed to correct operational and maintenance shortcomings at U.S. Air Force wastewater treatment plants. This is a three-phase program, as outlined below:

- Phase I - On-site diagnostic evaluation of a WWTP to identify shortcomings and determine what assistance is needed to correct them.
- Phase II - Preparation of a plant-specific Operation and Maintenance Manual and on-site implementation and support for improving O&M, sampling and lab testing.
- Phase III - On-site verification and benefit analysis to assess the effectiveness of assistance provided during Phase I and Phase II.

The Phase I site visit was conducted in October 1993. At the time of the visit, the Howard AFB WWTP was generally a well operated facility. The plant process operation did have some problems and it was the consensus of the evaluation team that the activated sludge system was operating less than effectively. The self-monitoring, plant discharge data does not totally reflect the ineffectiveness of the activated sludge system because discharge levels of biochemical oxygen demand (BOD) and total suspended solids are further reduced during the chlorination process and the effluent BOD is under-represented due to problems in performing the BOD test. The self-monitoring, effluent data collected in the twelve months previous to the evaluation had only one overseas baseline criteria exceedance for BOD and one for total suspended solids. These exceedances were both in April 1993 and were for the monthly averages. The major problems with the activated sludge system process operation are related to the lack of a clear cut, consistent process control strategy and problems with the secondary clarifier weirs.

Key recommendations of the Phase I Report include implementing a plant process control strategy, making improvements in sampling and lab procedures, making additions to lab equipment and flow monitoring equipment to facilitate process control, making renovations to the secondary clarifier weirs, increasing plant monitoring to include

metals and nutrients to ensure that the activated sludge system is not being inhibited, and making improvements to the influent pump station to provide steady-state flow to the plant. A total of 34 recommendations were made as a result of the Phase I visit.

The format of the Phase I report generally follows that provided in *A Guide to the Department of Defense Operation, Maintenance and Training Assistance Program (OMTAP) for Wastewater Treatment Plant Personnel,* June 1987. In addition, reference to particular points in the scope of work are included after pertinent discussions throughout the report.

The initial Phase II visit to Howard AFB is scheduled for March 16, 1994.

SECTION 1
INTRODUCTION

1.1 DESCRIPTION OF WASTEWATER TREATMENT PLANT ENVIRONMENTAL STUDY

The wastewater treatment plant environmental study is an outgrowth of the OMTAP (Operation, Maintenance and Training Assistance Program), a Department of Defense program designed to improve the performance of wastewater treatment plants located on military installations. The program is divided into three phases, each requiring visits to the treatment facility by a team of evaluators.

As the program is currently designed, the first phase involves a comprehensive diagnostic evaluation of the treatment processes to identify operational and/or design deficiencies. During this site visit, the evaluation team members conduct a comprehensive process evaluation and collect information needed to produce a draft of an operation and maintenance (O&M) manual for the plant. Reviews of operations, maintenance, and laboratory procedures are conducted. Evaluation of plant records and permit compliance are also conducted.

The second phase involves up to four site visits to conduct implementation and support for operators on procedures recommended to overcome those problems identified during the diagnostic phase. The visits occur over several months after the program is initiated at an Air Force installation. The team also validates the content of the draft O&M manual and examines operational problem areas in more depth.

The third phase, which occurs 6 to 12 months after the initial site visit, is a follow-up verification of plant performance to assess those improvements that have been made since the program was initiated and the benefits accrued. If needed, additional assistance that might benefit plant operators is provided.

1.2 PURPOSE OF PHASE I VISIT

The Phase I visit was conducted to perform an on-site diagnostic evaluation of the Howard Air Force Base wastewater treatment plant (WWTP). The purpose of the visit was to provide site-specific assistance to the WWTP staff to identify and correct deficiencies and less than optimum practices and procedures.

The Phase I on-site diagnostic evaluation of the WWTP was conducted during the period of October 25-29, 1993. Members of the ES Team included:

- Mike Hewitt - ES Project Manager
- Carlos Ortiz - ES Project Engineer

A kickoff meeting was held on the morning of October 25, 1993. An initial tour of the WWTP was conducted on the morning of the same day. Minutes of the kickoff meeting were provided in Letter Report No. 1, dated November 8, 1993.

During the period of October 25-29, 1993, the ES team members evaluated the operation and maintenance of the treatment facility. Several informal meetings were held between ES team members and plant personnel. Particularly involved in assisting the team members were:

- Lt. Col. Mike Schmidt - Deputy Base Civil Engineer
- Capt. Jeff Hewitt - Base Bioenvironmental Engineer
- TSgt. Roland Mourning - NCOIC WWTP
- Mr. Julio Alzamora - Assistant Foreman-WWTP

An exit briefing was held on the morning of October 29, 1993. The meeting was presided over by Lt. Colonel Schmidt. A summary of the Phase I site visit and initial recommendations were presented by the ES team. Summary recommendations were documented in Letter Report No. 2, dated November 8, 1993.

1.3 ACCOMPLISHMENTS OF PHASE I VISIT

During the Phase I visit, the OMTAP team made a number of significant accomplishments. The major accomplishments include:

- Diagnostic evaluation of each unit treatment process.

- Evaluation of sampling, laboratory procedures and analytical equipment.
- Evaluation of preventive maintenance and safety programs.
- Evaluation of plant record keeping systems.
- Evaluation of operator job skills, certification levels, training, and morale.
- Evaluation of management structure for the WWTP.
- Evaluation of the effect of nondomestic discharges on the WWTP.
- Inspection and evaluation of remote lift stations.

1.4 INSTALLATION OVERVIEW

Howard AFB is located in the republic of Panama, approximately 10 miles west of Panama City. The Base consists of approximately 5,000 acres. The areas immediately adjacent to the Base are primarily agricultural and residential. Howard AFB is home to the 24th Wing of the Air Combat Command (ACC). The primary mission of the Base is to support the 24th Wing. The on-base population of military and their dependents is approximately 5,000 persons. In addition, an off-base military population of approximately 3,000 and civilian and contract work force personnel of 1,000 comprise the total base usage of nearly 10,000 persons. Industrial activities at Howard AFB can be grouped into three general categories: aircraft and flightline maintenance, facility and transportation maintenance, and petroleum, fuels and lubricants operations. These operations are performed at locations throughout the base. It is estimated that 1 to 2 percent of wastewater discharged to the WWTP from the Base is industrial. This constitutes approximately 10,000-20,000 gallons per day of industrial flow.

The Howard AFB WWTP and lift stations are operated by a combined staff of military and civilian operators. The treatment plant is located in the southeast corner of the base. There are seven sewage lift stations which are tributary to the base WWTP. These lift stations are located throughout the base and also pump sewage from the Farfan Naval Station housing area.

1.5 OPERATING PERMIT REQUIREMENTS

A primary objective of this WWTP Environmental Study is to ensure that the operation of the WWTP maintains compliance with the Overseas Environmental Baseline Guidance Document criteria. The Howard AFB WWTP discharges to an unnamed

tributary which discharges to the Bay of Panama. The overseas guidance criteria are presented in Table 1.1.

In addition to the criteria presented in Table 1.1, general operating requirements which should be followed are summarized below. These requirements are not listed in the criteria document but are those usually required by National Pollutant Discharge Elimination System Permits and Federal Pretreatment Regulations at US Air Force installations in the U.S.

1. The plant should have a continuous recording flow monitoring system capable of measuring and recording the total and maximum daily flow.
2. Influent samples must be collected and analyzed for BOD, Total Suspended Solids and pH at the same frequency as required for the effluent.
3. Semiannual sampling and analysis of the influent, effluent and sludge should be performed for metals and priority pollutants.
4. Samples and measurements shall be representative of the volume and nature of the discharge. Sludge samples shall be collected at a location representative of the quality of sludge being disposed.
5. Records of monitoring data shall be maintained including the date, exact place, and time of sampling or measurement, the initials of the person performing the measurement, the dates and times the analyses were performed, a reference to the written procedure used and the raw data and final result of the analyses.
6. The plant is to be properly operated and maintained including all installed equipment used to achieve compliance. Proper O&M includes adequate laboratory controls and quality assurance measures.
7. Removed substances such as sludge, grit and screenings must be properly disposed of so as to not cause pollution or a health hazard.
8. Industrial waste management should be fully implemented to prevent the discharge of pollutants into the plant which are prohibited, which interfere or pass through the plant or which exceed federally mandated pretreatment standards at U.S. DOD installations.

TABLE 1.1

Overseas Environmental Baseline Guidance Document Criteria

Parameter	Units	30-Day Average	7-Day Average	Daily Maximum	Daily Minimum
Biochemical Oxygen Demand (5-day)	mg/l	45	65	--	--
Suspended Solids	mg/l	45	65	--	--
Fecal Coliform*	Colonies/ 100 ml	--	monitoring only	--	--
pH	Standard Units	--	--	9.0	6.0

* - Fecal Coliform monitoring requirements were added as a recommendation following an ECAMP inspection.

SECTION 2
PLANT DESCRIPTION

2.1 GENERAL

The Howard AFB WWTP is a biological treatment process achieving secondary treatment levels utilizing the activated sludge process. The treatment plant's original design and construction date is unknown. The most recent major modification occurred in 1972-1974. At that time the current activated sludge plant was designed and constructed.

2.2 WASTEWATER CHARACTERIZATION

The plant influent is primarily domestic and, although the industrial waste flow is not monitored, it is estimated that 1-2 percent of the wastewater is from industrial contributions. The influent wastewater to the treatment plant is characterized by an average biochemical oxygen demand (BOD) of 117 mg/l with a range from a low of 29 mg/l to a high of 275 mg/l. Influent total suspended solids (TSS) averaged 98 mg/l with a low of 18 mg/l and a high of 316 mg/l. These data were compiled from the period October 1992 through September 1993. These values are consistent with average, high and low values for influents to domestic wastewater plants in the United States.

The wastewater treatment plant is receiving an average influent flow of 0.947 million gallons per day (mgd). The range for daily influent flow during the period October 1992 through September 1993 was a high of 1.28 mgd and a low of 0.538 mgd. The average flow to the WWTP is lower than the average design capacity. The plant is designed for 1.25 mgd and at present is being hydraulically loaded at approximately 76 percent of design capacity.

2.3 KEY TREATMENT PROCESSES

The Howard AFB WWTP is a biological treatment system employing the activated sludge process. The key unit processes are:

- Screening

- Grit Removal
- Comminution
- Biological Treatment (Activated Sludge)
- Secondary Clarification
- Disinfection (Chlorination)
- Aerobic Digestion
- Sludge Dewatering (Drying Beds)

2.4 FLOW SCHEMATIC DIAGRAM

Figure 2.1 presents a schematic diagram of the Howard AFB WWTP. Major unit processes and flow streams are identified in the schematic.

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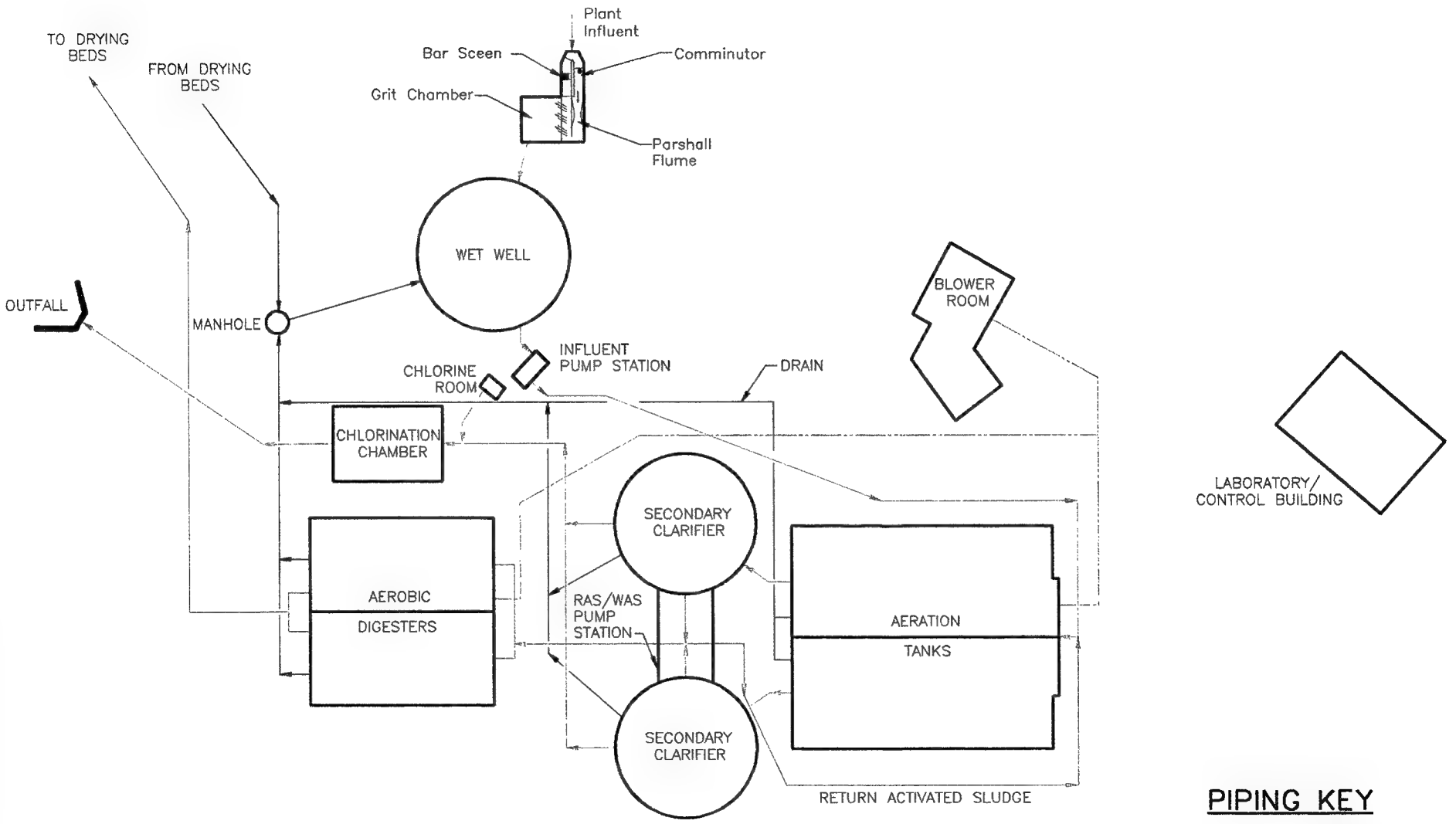
FLOW SCHEMATIC

HOWARD AIR FORCE BASE
WASTEWATER TREATMENT PLANT



PIPING KEY

- WASTEWATER LINE
- SLUDGE LINE
- AIR LINE
- DECANT, FILTRATE, AND DRAIN

Figure 2.1

SECTION 3
PLANT STAFFING AND MANAGEMENT

3.1 PLANT STAFFING LEVEL AND ORGANIZATION

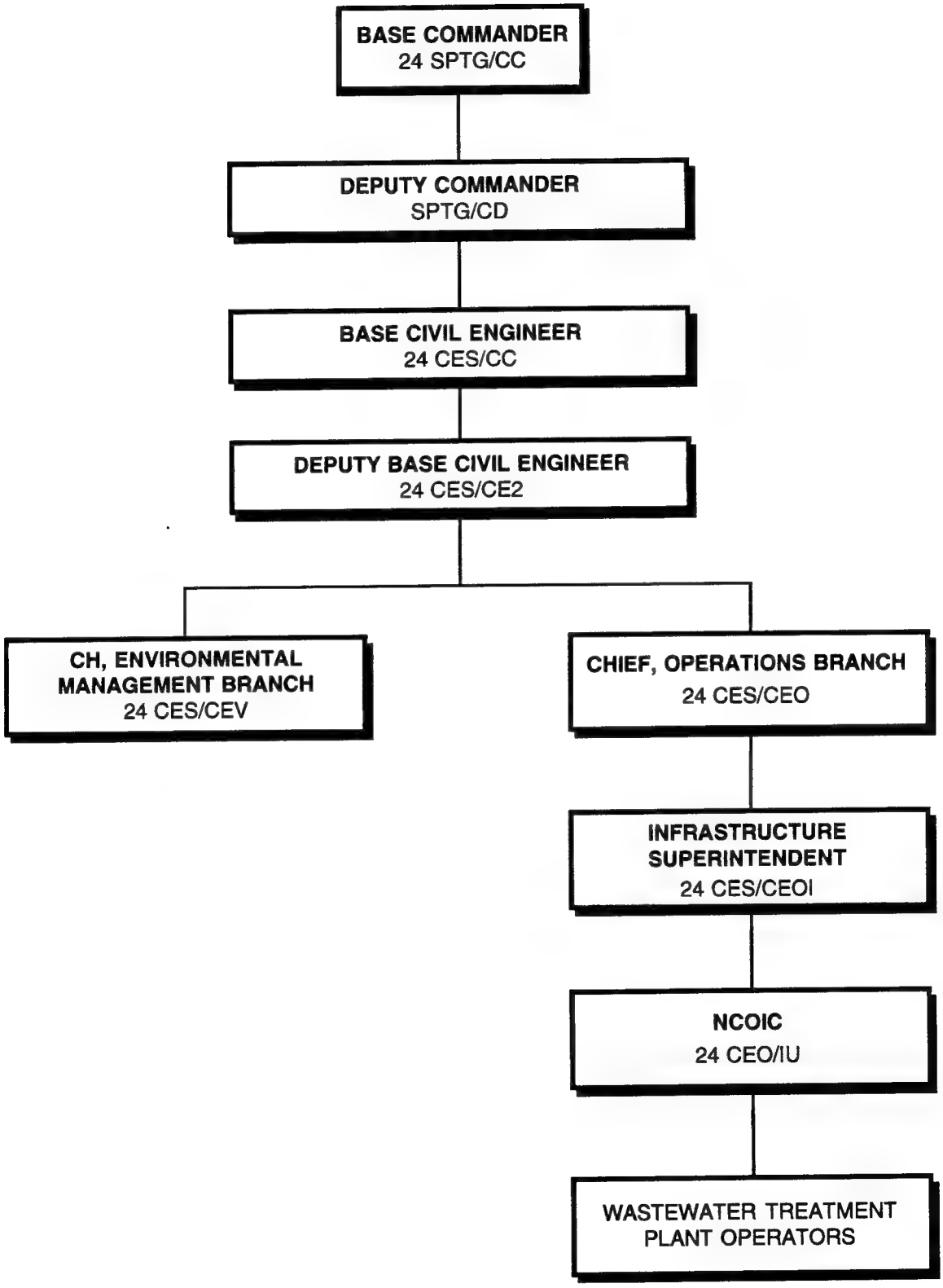
Currently the Howard AFB WWTP is staffed by one Non-Commissioned Officer In Charge (NCOIC), one assistant operations foreman, two shift supervisors, one maintenance mechanic and five operators. One of the operators is military and four are civilians. The overall management of the wastewater treatment plant is directed by the Infrastructure Superintendent and above that position is the Chief of the Operations Branch of Civil Engineering. An organizational chart for the WWTP is provided in Figure 3.1. The NCOIC, assistant foreman and operations personnel staff the plant 16 hours per day. In addition to the wastewater treatment plant and laboratory, the O&M personnel are responsible for seven lift stations, four water booster stations and two swimming pools. It is estimated that all civilian operators spend approximately 65% of their time on activities related directly to the wastewater treatment plant or laboratory due to their other responsibilities. The maintenance mechanic is approximately 35% available for plant maintenance. The military operator has approximately 65% utilization on plant O&M. The NCOIC is approximately 42 percent available for plant O&M supervision after taking into consideration his military and off-plant responsibilities. This results in a total available manpower of six full-time persons for the wastewater treatment.

3.2 OPERATOR GRADE STRUCTURE

The civilian operators, classified as Wastewater Treatment Plant Operators are Canal Zone Merit System grade MG-8. The assistant foreman and shift leaders are grade MG-9 and the maintenance mechanic a grade MG-10. In addition, an hourly wage differential is paid for shift work and a premium is paid for Sundays and Holidays.

The pay scales for civilians operators were difficult to evaluate against pay scales for operational personnel in the U.S. The pay scales are set by the Panama Canal Zone Merit System and are established using local economic conditions, job market place factors and

HOWARD AFB WWTP ORGANIZATIONAL CHART



cost of living considerations. Most of the operators have been in their positions for a length of time that does not suggest that pay scales are affecting turnover levels.

3.3 OPERATOR DUTIES

The plant operators are all required to perform operation and maintenance duties. In addition some operators also perform laboratory functions. Military and civilian personnel receive on-the-job-training in performance of operation, maintenance and laboratory duties. At present, no formal WWTP training is available for military or civilian operations personnel.

During Phase I, the ES evaluation team observed the plant operators in the execution of routine O&M and laboratory tasks. The operators performed their duties in an effective manner. The execution of routine duties was carried out in a manner dictated by operator experience. A set of standard operating procedures (SOPs) is available at the plant. The SOPs consist of a weekly schedule of plant items to be checked, readings to be taken, samples to be collected and tests to be conducted. Times are provided for each day of the week for each task in a matrix format. In addition, custodial type responsibilities are listed for each shift on a separate SOP. SOPs are provided for grounds maintenance activities as well. Listings of operator duties for the second and third shift are also included with the SOPs even though the third shift is currently not being manned. Written SOPs are provided for sampling and for each analytical test procedure. An SOP is also provided for calibration of the D.O. meter. From our observations, most of these documents are used to a greater or lesser extent depending on the level of familiarity of the operator with the particular procedure. One improvement that could be made to ensure that all assigned duties are performed is to develop operator checksheets for each shift. These would serve as an excellent format for items to be completed on each shift. Some of the information within current procedures could be adapted to a checklist format. This approach will be further explored and checksheets developed for the O&M Manual. (1.4.12)

3.4 CERTIFICATION REQUIREMENTS

The Howard AFB is the only activated sludge wastewater treatment plant in the Panama Canal Zone. Currently there are no wastewater treatment plant requirements for operator certification and training. It is recommended that a training standard be developed for the civilian operators. This might be accomplished through the Canal

Zone Merit System Qualification Standard for the Wastewater Treatment Plant Operator position. A correspondence course such as "Operation of Wastewater Treatment Plants" offered by the California State University at Sacramento would be an excellent course to utilize as the standard. This course could be implemented for training of plant operators either in a correspondence course, self-study format or by utilizing in-house instruction and supervised examination. (1.4.1.6)

3.5 ADEQUACY OF STAFFING

Currently there are nine O&M personnel for the Howard AFB WWTP. As discussed in Section 3.1, the operators, maintenance mechanic and supervisory staff have other duties related to the lift stations, water booster stations, and swimming pools which reduce their total utilization time for plant O&M. Our analysis of these utilization factors indicate that there are the equivalent of six full-time O&M persons for the plant. Currently the plant operates 16 hours per day. The 1600-2400 hours shift utilizes two persons on the shift and the 2400-0800 hours shift is unmanned. Plant personnel told the ES evaluation team that night shifts had to be manned with two persons due to security concerns and the lack of a perimeter security fence around the plant. This scenario in essence prevents the manning of the third shift due to the lack of manpower. However, other than for security reasons, there are no other outstanding reasons to double-man the second shift. Furthermore, activated sludge operations require more attention than can be provided to the plant under the current staffing/operation schedule.

It is recommended that the Base consider installing security fence around the WWTP and begin manning the plant 24 hours per day. With one man on each of the two night shifts, the staffing level currently in place is adequate.

Another possible scenario for staffing the plant was discussed during the evaluation. TSgt. Mourning indicated to the evaluation team that three additional military operators were going to be assigned to the plant in the future. If this occurs, 24 hour staffing of the plant should be initiated irregardless of the security fence issue (1.4.1.6). If the evening and night shifts are manned by one person per shift, that person would always be in contact with the Civil Engineering Control Desk by radio. This could mitigate some of the plant security concerns.

3.6 PROMOTION OPPORTUNITIES

Promotional opportunities are available within the WWTP organization but normally are limited to vacancies occurring in shift leader positions. There are also some opportunities for advancement into merit system jobs elsewhere on base if an individual is qualified. (1.4.1.6)

3.7 MORALE OF THE WASTEWATER OPERATORS

The morale of all the operators interviewed by the evaluation team was very good. All the operators exhibited enthusiasm for their jobs and were willing to work on projects to improve the operation of the WWTP. (1.4.1.6)

3.8 ADEQUACY OF EXISTING DOCUMENTS

The WWTP currently does not have a site-specific O&M Manual. Standard Operating Procedures (SOPs) are available for the routine operations performed in the treatment plant and the laboratory. However, these SOPs are for the most part not specific enough or not comprehensive. More complete SOPs will be developed for both the plant and laboratory and checksheets will be developed for the O&M and sampling routines conducted on a daily basis. The plant had some excellent flow diagrams available for the plant and individual unit process operations which will be utilized for inclusion into the O&M manual. Design drawings are also available at the plant. The ES evaluation team obtained a copy of these drawings for use in development of material for the O&M Manual. Equipment and vendor manuals were available on a selective basis. These will also be used to develop preventive maintenance schedules for each equipment item in the plant. The plant had a wealth of information files on the base-wide safety system. The system of files and equipment information, although fairly complete, was not well organized and required plant personnel considerable time to find some material. The plant filing system should be reorganized and file drawers should be labeled for easy location and access of materials. (1.4.1.4)

3.9 EXISTING TRAINING PROGRAM

As was mentioned in Section 3.3, there are no formal training programs available for the civilian or military operators at the Howard AFB. OJT is the primary training mechanism used. Additional training is needed for the operators to ensure that they all have a solid foundation in wastewater treatment concepts. This is particularly true in instances when new personnel begin working at the WWTP. As already mentioned in

Section 3.4, a correspondence course such as "Operation of Wastewater Treatment Plants" offered by the California State University at Sacramento would be an excellent course. This course could be implemented for training of plant operators either in a correspondence, self-study format or by utilizing in-house instruction and supervised examination.

Also, outside seminars and workshops directly related to the Howard AFB WWTP should be attended at least annually by civilian plant personnel, especially the plant assistant foreman or shift leaders. This was discussed at the time of the Phase I evaluation and it was requested by the Base that the ES evaluation team identify potential courses or workshops that the plant assistant foreman might attend. Two courses have been identified which are offered by the University of Florida, Center for Training, Research and Education for Environmental Occupations (TREEO). TREEO is located in Gainesville, Florida but courses are offered at various locations around the state. Course brochures, calendars and costs for TREEO are included in Appendix A of this report. Also, a listing of wastewater courses offered by the University of California at Sacramento, the program address and phone numbers are also included in Appendix A.

It is also recommended that the following reference/training manuals be provided at the plant for operators to use for independent study.

- Sacramento Course - *Operation of Wastewater Treatment Plants,* Volumes 1 and 2.
- Sacramento Course - *Industrial Waste Treatment*
- Air Force Manual AFM 91-32 - *Operation and Maintenance of Domestic and Industrial Wastewater Systems*
- Standard Methods for the Examination of Water and Wastewater, 18th Edition
- Manual of Practice OM-9 - Operation and Maintenance of Activated Sludge Plants
- Manual of Practice 7 - Operation and Maintenance of Wastewater Collection Systems
- Manual of Practice OM-3 - Plant Maintenance Program
- Manual of Practice 11 - Operation of Wastewater Treatment Plants

- Manual of Practice OM-1 - Wastewater Sampling for Process and Quality Control

All of the above manuals of practice (MOP) are available from the Water Environment Federation. (1.4.1.6)

3.10 MANAGEMENT EVALUATION

Recently the NCOIC position at the wastewater treatment plant underwent a turnover. The current NCOIC, TSgt. Roland Mourning is relatively new to the field of wastewater treatment. Part of TSgt. Mourning's approach to management of the WWTP has been to rely heavily on the civilian operating staff for input into technical operational decisions. This is the correct approach in the view of the ES evaluation team given the experience level of the plant assistant foreman and shift leaders. TSgt. Mourning is still relatively new to the wastewater treatment field and has had limited training and exposure to technical wastewater treatment issues. Implementation of the recommendations made in this report will be facilitated by the WWTP NCOIC, whether that be TSgt. Mourning or a future NCOIC, if that individual is well versed in the wastewater treatment field. This will require additional training and improvement in technical knowledge in wastewater treatment. TSgt. Mourning holds a staff meeting once per week on Wednesday at 1500 hours to ensure that important information is communicated. This meeting is also used for plant safety briefings.

Another observation made regarding management of the WWTP is that there is solid commitment on the part of upper management in the Civil Engineering Squadron and Headquarters of Air Combat Command (HQ/ACC) to making needed improvements to the plant. Funds have been allocated for this Wastewater Treatment Plant Environmental Study by HQ/ACC, and, in addition, a small design upgrade which will take place in 1994 has been funded. (1.4.1.6)

SECTION 4
PLANT OPERATIONS/PROCESS CONTROL

The Wastewater Treatment Plant (WWTP) receives mainly domestic wastewaters generated at housing and office buildings located throughout the Base. Wastewaters generated at the maintenance shops are normally treated to remove floating oils prior to their discharge to the sanitary sewer or surface waters.

4.1 OVERVIEW OF THE TREATMENT PLANT

4.1.1 Collection System

The sanitary system collects domestic wastewater generated at Howard AFB and the housing complex of Farfan U.S. Naval Station. Sanitary wastewater flows by gravity to seven lift stations located throughout the Base. These lift stations are:

Station 718

Station 225

Station 49

Station 8

Station 1

Station 949

Station 735

All lift stations are normally checked twice daily to detect unusual or excessive noise, vibration and overheating, and to test level controls. The buildings and grounds are well maintained. The exterior and interior walls are painted and clean. Each station has two pumps and one pump serves as a back-up during high flows. From our understanding, these pumps do not automatically alternate. One pump remains the lead while the second remains the lag pump. Normally, the lead-lag status of pumps is alternated to equalize service of the two pumps and equalize wear and maintenance related costs. The possiblity of manually alternating the lead-lag status of pumps on all lift stations should be considered.

Lift station 718 is located in the corner of Mulvehill Avenue and Bryant Avenue. The station has 2 vertical pumps. At the time of the evaluation, one pump was out of service to replace the mag-starter and repair the check valve. The station is provided with an exhaust fan and two screened windows for ventilation.

Station 225 is located on Mulvehill Avenue in the vicinity of the base passenger terminal. The station has two (2) operable vertical pumps. The evaluation team was not able to determine the design capacity of this station from information obtained during the evaluation. The louvers on the pump housing provide ventilation to the station.

Station 49 is located on the corner of Suliber Avenue and Andrews Boulevard, across the street from the Commissary. This station receives wastewaters generated at the Commissary, Civil Engineering Building and the Day Care Center. The station has two (2) operable pumps. We were not able to determine the design capacity of this station from information obtained during the evaluation. Ventilation of the station is achieved through the louvers of the pump housing.

Station 8 is located at the south end corner of the Motor Pool. The station has two (2) operable vertical pumps. This station is provided with an exhaust fan and two screened windows for ventilation.

Station 1 is located behind the Civil Engineering building and has two (2) vertical pumps. At the time of the evaluation, one pump was out of service to replace the motor. We were not able to determine the design capacity of this station from information obtained during evaluation.

Station 949 is located on Beard Road and receives wastewaters from Farfan U.S. Naval Station Housing Area, Howard AFB Elementary School and Gateway Family Housing. The station has two (2) operable vertical pumps. This station is provided with an exhaust fan and louvered windows for ventilation.

Station 735 is located at the corner of Andrews Boulevard and Bryant Avenue and receives all wastewaters generated at the Base. This station has two (2) operable pumps. Ventilation is deficient at this station. Hydrogen sulfide (H_2S) gas was detected during the evaluation. A new ventilation fan and louvered windows should be installed to ensure a supply of fresh air into the station.

4.1.2 Preliminary Treatment

Raw wastewater enters the treatment plant through an 18-in pipe to a 12-in channel provided with a comminutor. A 9-in Parshall flume with an ultrasonic sensor is located approximately 7 ft downstream of the comminutor to measure the influent flow. The ultrasonic signal is sent to an ISCO™ flow meter (Model 2440) and a totalizer. The totalizer is located in the laboratory/control building, but was out of service at the time of the evaluation.

Forward influent flow continues from the Parshall flume to a horizontal grit chamber. Grit which settles in the bottom of the chamber is raked by a rotating mechanism to a sump at the side of the chamber, from which it is removed by a screw conveyor. The screw conveyor is controlled manually and discharges into a 50-gal drum. The contents of this drum are currently disposed of on the plant grounds. The wastewater flow continues from the grit chamber to the influent wet well, passing through a manual bar screen with 2-inch wide openings. Screenings are removed manually with a rake (7-9 times a day), put into the grit storage drum and disposed of on the surface of the plant grounds. Surface disposal of screening and grit is a potential health hazard and should be discontinued. These materials should be buried on plant grounds or they should be taken to a sanitary landfill if available. (14.1.1)

4.1.3 Influent Pump Station

The influent pump station has a wet well and two operable vertical variable speed pumps. The influent wet well is a modified Imhoff tank. The bottom of the original structure has been filled up with sand and topped with a 4-in concrete slab. The storage capacity of the wet well is approximately 88,850 gal. Each pump delivers a maximum flow of 1,000 gpm. At the time of the evaluation, the variable speed drives were not functioning properly. Therefore, pumps were operated at their maximum capacity. Because the pumping rate of this station periodically exceeds the influent flow rate to the wet well, aeration basins and clarifiers are subject to intermittent flow. This intermittent flow is detrimental to the steady-state conditions required for efficient biological treatment. All efforts should be made to renovate the variable speed drives and to control their operation off a signal from the influent flow meter. This will probably involve reducing the capacity of the lead pump so that operation at its lowest speed corresponds to the lowest flow during the 24-hour cycle. (1.4.1.1)

4.1.4 Aeration Basins

The WWTP is provided with two aeration tanks for the biological treatment of organic wastes. The pretreated influent enters a splitter box, where it is mixed with the return activated sludge (RAS). Each aeration tank has a rectangular section of 55.5 ft by 25 ft and a side water depth (SWD) of 15 ft, for a hydraulic capacity of approximately 159,400 gal. The total aeration basin volume is 318,800 gallons. The current loading rates to the system are as follows:

Hydraulic Loading Rate	344 gpd/ft^2
Volumetric Organic Loading Rate	22.2 lb BOD/1,000 ft^3

The volumetric organic loading rate is in the lower end of the recommended range for conventional activated sludge systems (i.e., 18.7 to 37.5 lb BOD/1000^3-d). The average mixed liquor suspended solids (MLSS) concentration maintained in the system is approximately 1,100 mg/L. The volatile fraction has been determined periodically at an off-site lab and is approximately 70% of the solid mass. Based on the organic loading rate and the MLVSS concentration maintained in aeration tanks, the activated sludge system is currently being operated at a F/M ratio of 0.45 lb BOD/lb VSS-d. This ratio slightly exceeds the recommended range for conventional activated sludge systems (i.e., 0.2 to 0.4 lb BOD/lb MLVSS-d). At high F/M ratios the efficiency of the biological system will decrease as the waste utilization rate of the microorganism is exceeded.

Diffused air is applied to maintain aerobic conditions and to provide mixing power. The average dissolved oxygen (D.O.) concentration varies between 1.0 to 1.8 mg/L. Good BOD removal is occurring across the aeration tank and final clarifiers; however, it is important to maintain a 2.0 mg/l D.O. concentration in all parts of the aeration basins. Plant personnel told the ES evaluation team that at times delivering sufficient air to the basins has been a problem due to leaks in the air header line. The air header line is under contract to be repaired in the near future.

The lack of flow measuring devices to estimate sludge recycling rates, in addition to intermittent influent flows, affects the operation of the activated sludge system. All efforts should be made to install a flow meter in RAS line to properly control return rates and to maintain steady hydraulic conditions across the biological treatment system. (1.4.1.1)

4.1.5 Secondary Clarifiers

Two circular secondary clarifiers are provided for the settling of biological sludge. The effluent of the aeration tanks flows to the secondary clarifiers through a wide-crest weir, a 1.5 ft trough and 18-in cast iron pipes. The trough is equipped with a sluice gate for flow distribution. The content of each aeration tank can be discharged separately to the corresponding clarifier if required.

The units are 35 feet in diameter and have a SWD of 8.5 feet. The side water depth is 1.5 ft. below most minimum recommended design criteria. This difference can have a profound effect on the performance of the clarifiers if other operating and design conditions are less than optimum. A collection trough around the perimeter of each clarifier receives the effluent. Current available surface area for both units combined is 1924 ft^2. Current available volume is 122,340 gallons. Operating parameters for the secondary clarifiers under average flow conditions of 0.947 MGD area as follows:

Surface loading rate	492 gpd/ft^2
Solids loading rate	4.54 lb TSS/ft^2-d
Hydraulic retention time	3.1 hours

The surface loading rate and hydraulic retention time are within recommended design values. The solids loading rate, however, is below the recommended design range (i.e., 20 to 30 lb TSS/ft^2-d).

Two major operational problems in the clarifiers were detected during the evaluation. First, the effluent weirs of the units were not leveled. The uneven distribution of flow throughout the weir length produces a short circuit pattern that removes solids from the bottom of the clarifiers and carries them over the weirs. Consequently, low inventory of solids and RAS concentrations are maintained in the system.

Second, the lack of flow meters in the RAS and waste activated sludge (WAS) pipes affects the operational control of the biological system and the clarifiers. Currently, it is difficult to control the sludge blanket depth without a flow metering device to adjust sludge pumping rates. Due to these operational problems it has been difficult to implement a consistent process control strategy. Attempts have been made to control the plant operation based on sludge age, but the analytical data utilized have produced erratic

results. A discussion on laboratory procedures and limitations is presented in Section 6. (1.4.1.1)

4.1.6 Chlorine Contact Chamber

The WWTP is equipped with a chlorine contact chamber which is 20 feet long, 16 feet wide and 10 feet deep. Its length-to-width ratio is 1.25. Baffle walls direct the flow in an upward-downward pattern throughout its length. At the current average flow of 0.947 MGD, this basin has a more than adequate hydraulic retention time of 61 minutes.

Chlorine gas is fed through wall-mounted chlorinaters and chlorine injection into the basin is accomplished using a pipe which routes chlorine solution into the head of the basin. An average of 41 pounds of chlorine gas per day is being fed to disinfect the effluent and is resulting in an average total chlorine residual in the effluent of 0.25 mg/L. There are no limits or requirements on the effluent chlorine residual.

Chlorine gas feed control is manual. The plant operators take samples which are analyzed for Total Chlorine Residual. These data are used to make adjustment in the chlorine feed rate. The main problem with this manual control system is its lack of consistency and reliability. Consistency is particularly difficult when the plant is unmanned during the night shift. (1.4.1.1)

4.1.7 Aerobic Digesters

The Howard AFB WWTP is equipped with two aerobic digesters. Each unit has a surface area of 800 ft^2 (40' x 20') and a 15.5-ft SWD for a unit volume of 92,750 gal. The total volume of the two units is 185,500 gallons. Diffused air is provided to maintain aerobic conditions and mixing level requirements.

The average flow to the digesters (i.e., WAS) is approximately 15,400 gpd and the average solids concentration is 2,870 mg/L. Therefore, the current loading factor is approximately 0.012 lb TSS/ft^3-d. This loading level is below the design range for aerobic digesters (i.e., 0.024-0.14 lb solids/ft^3-d).

The average retention time for digestion is approximately 45 days. Since the hydraulic capacity of the digesters can provide a total retention time of 12 days, it is necessary for the operators to decant and concentrate the sludge. Control of the digesters is currently based primarily on non-volatile suspended solids concentration. Sludge is digested until a 40% increase in non-volatile suspended solids is achieved or when

decanting becomes difficult to achieve. At this point in time, the contents of a unit are discharged into a drying bed. Control of digesters should be based on percent reduction in volatile solids. Volatile reduction should be greater than 40 percent. (1.4.1.1)

4.1.8 Sludge Drying Beds

There are a total of four (4) covered drying beds. Each bed is 120 feet long and 25 feet wide. All four are in service, but appear to drain slowly. Based on information provided by the operators, it takes from 2 to 3 months to obtain a dried cake. Poor sludge drying could be the result of excessive loading, slime coated media or plugged under drainage system. Operational personnel indicated that they load the drying beds to a level of 18-24 inches. This is far greater than the recommended 8-12 inches. Further evaluation of the drying media should be performed and replacement of sand and gravel must be implemented if required. (1.4.1.1)

4.1.9 Instrumentation

The WWTP is equipped with the following instrumentation:

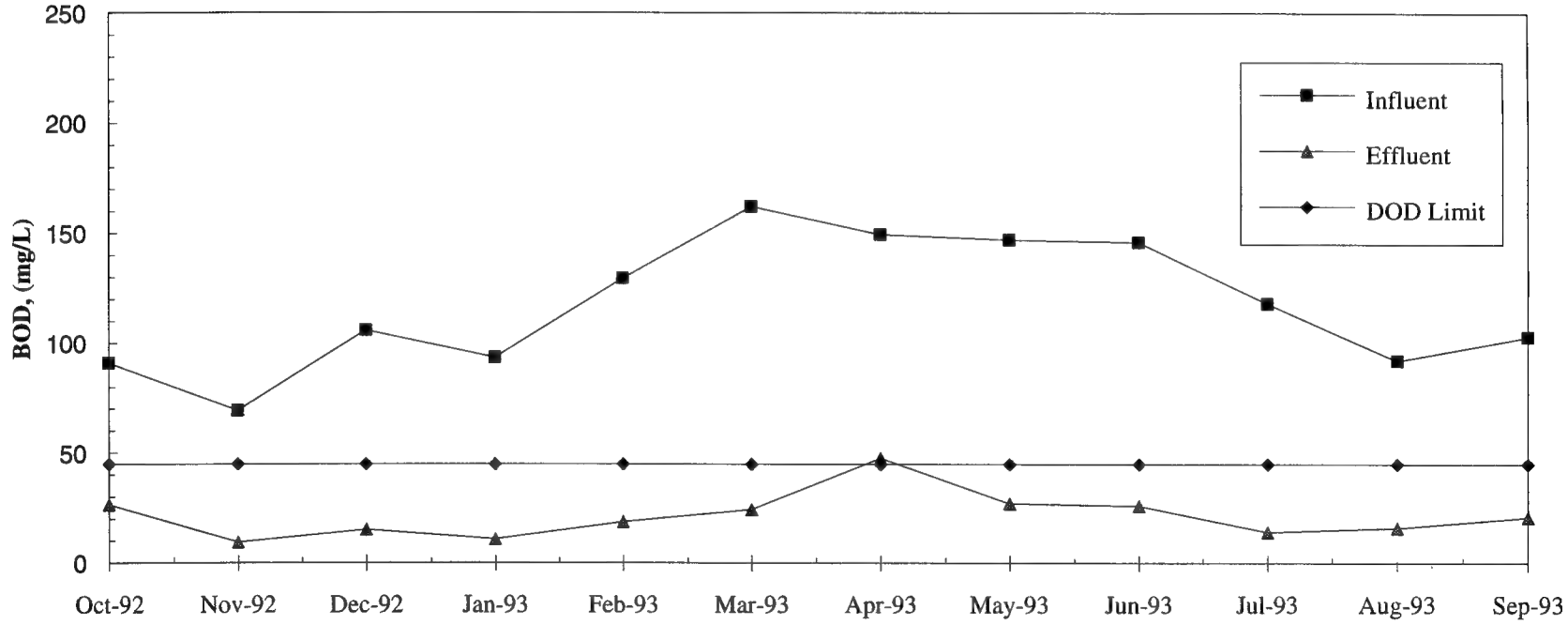
- Influent flow meter
- Influent flow indicator/totalizer
- Influent wet well level controls

The flow meter indicator/totalizer was out of service. There was no evidence that the flow meter is serviced and calibrated regularly by a manufacturer's representative or a qualified electronics technician. This activity should be undertaken. (1.4.1.1)

4.2 DESCRIPTION OF THE PLANT PERFORMANCE

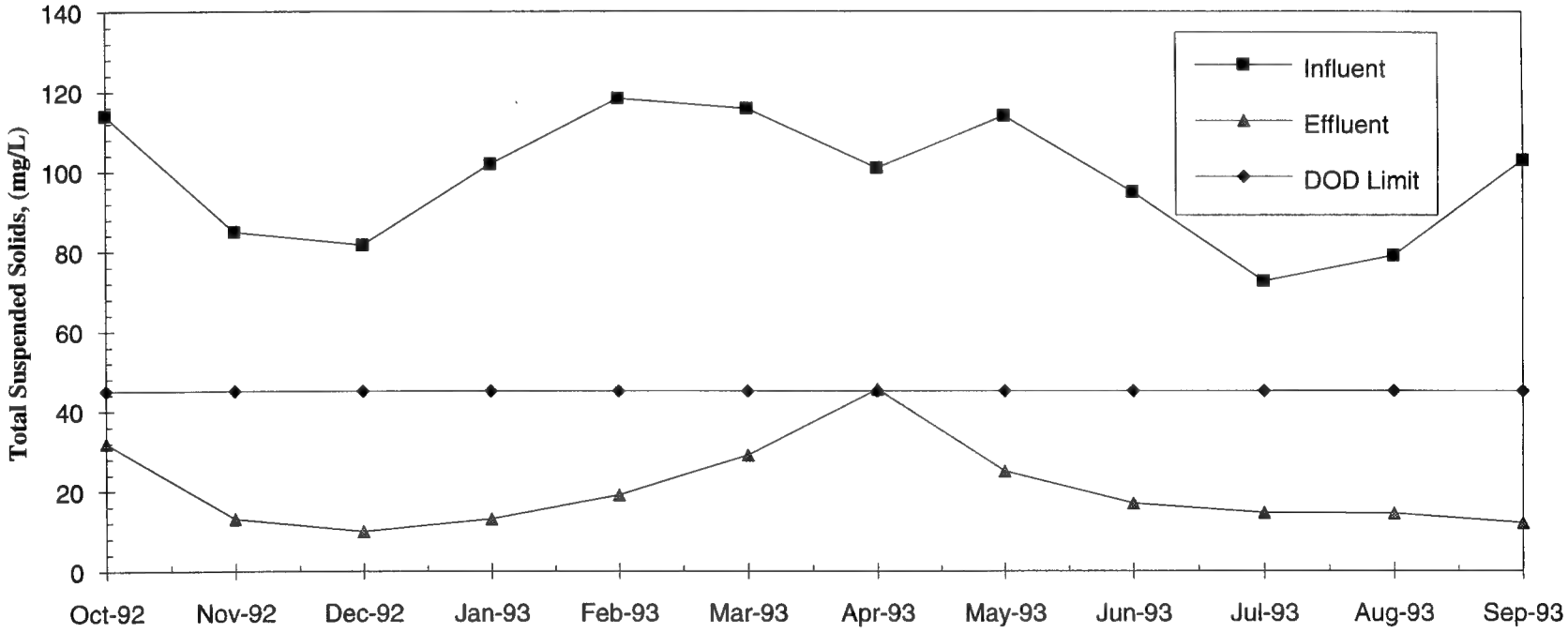
The evaluation team examined plant monitoring reports for the previous 12 months to evaluate compliance with the Overseas Environmental Baseline Guidance Document. Overall, the performance of the WWTP is good. The WWTP is operating below its design capacity. On the two parameters used for measuring plant performance, BOD and TSS, there has been only one exceedance of the Overseas Environmental Guidance criteria. Figures 4.1 and 4.2 illustrate the monthly average for influent and effluent BOD and TSS over the period October 1992 through September 1993. The daily effluent BOD for this period ranged from 10 mg/L to 48 mg/L. The daily effluent TSS concentrations varied from 10 mg/L to 46 mg/L. (1.4.1.3)

Figure 4.1. Variation of Average BOD, Howard AFB, Panama



AA011\Fig 1

Figure 4.2. Variation of Average TSS Concentration, Howard AFB, Panama



AA011\Fig 2

The average influent flow to the WWTP, over the period of October 1992 to September 1993 varied from 0.82 MGD to 1.11 MGD; and the maximum flow ranged from 0.95 MGD to 1.93 MGD (Figure 4.3). Based on rainfall data collected at the WWTP it is difficult to establish a direct relationship between rainfall and influent flow variations. There does not appear to be a major problem however with infiltration and inflow into the collection system. This is further illustrated by Figure 4.4 on which flow versus rainfall is plotted for late June and July 1993, the period with the greatest rainfall during the review period.

4.3 NON-DOMESTIC DISCHARGES

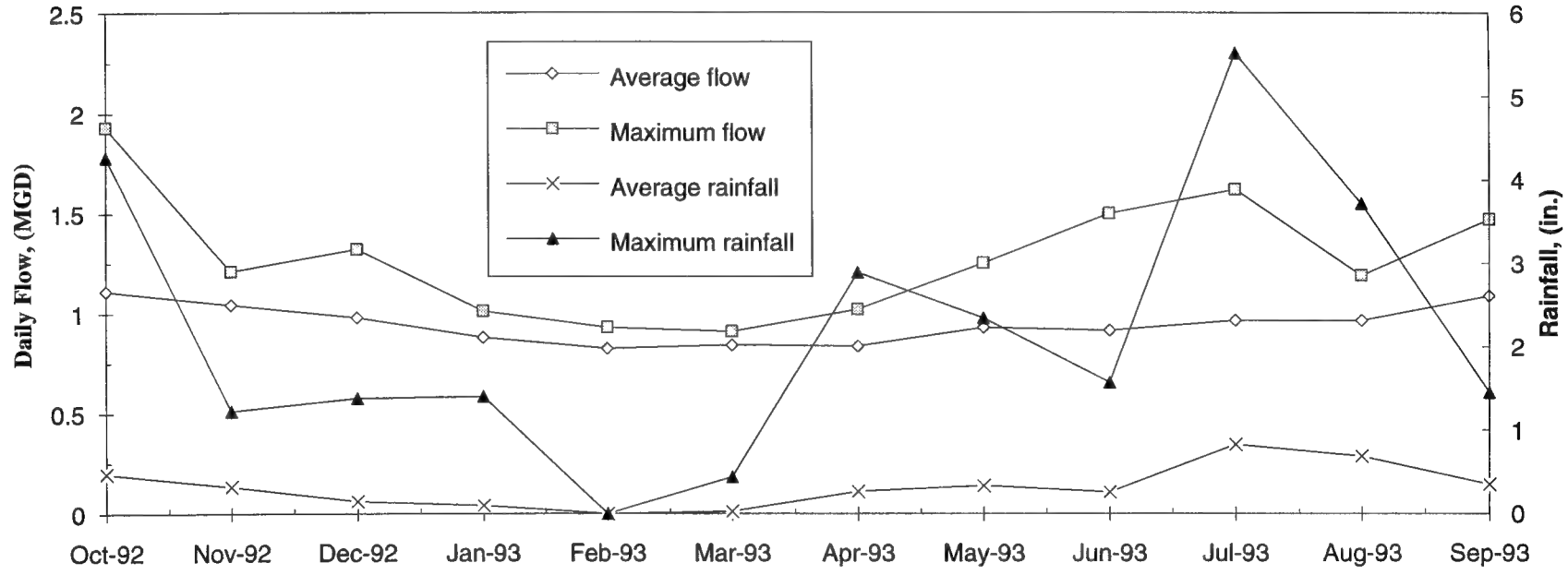
Based on review of the Hazardous Waste Management Survey Report prepared by Radian Corporation (July 1993), ten potential non-domestic wastewater sources were identified at the Base which could have an impact on the WWTP:

- 24th CES Sheet Metal/Welding Shop, Bldg. 4
- 24th Pavements, Equipment and Grounds, Bldg. 11
- CE Supply, Bldg. 145
- Chrysler Technologies, Bldg. 241
- Hangar #4, Bldg. 253
- Electro/Environmental Shop, Bldg. 256
- AAFES Service Station, Bldg. 700
- 24 SG/MWR Auto Hobby Shop, Bldg. 722
- Air Intelligence Squadron, Bldg. 723
- Hangar #1, Bldg. 236

Each potential source was evaluated through direct visits and information supplied by members of the Bio-Environmental Engineering Office. A brief description of the operations and the wastewater generated at each facility is presented below.

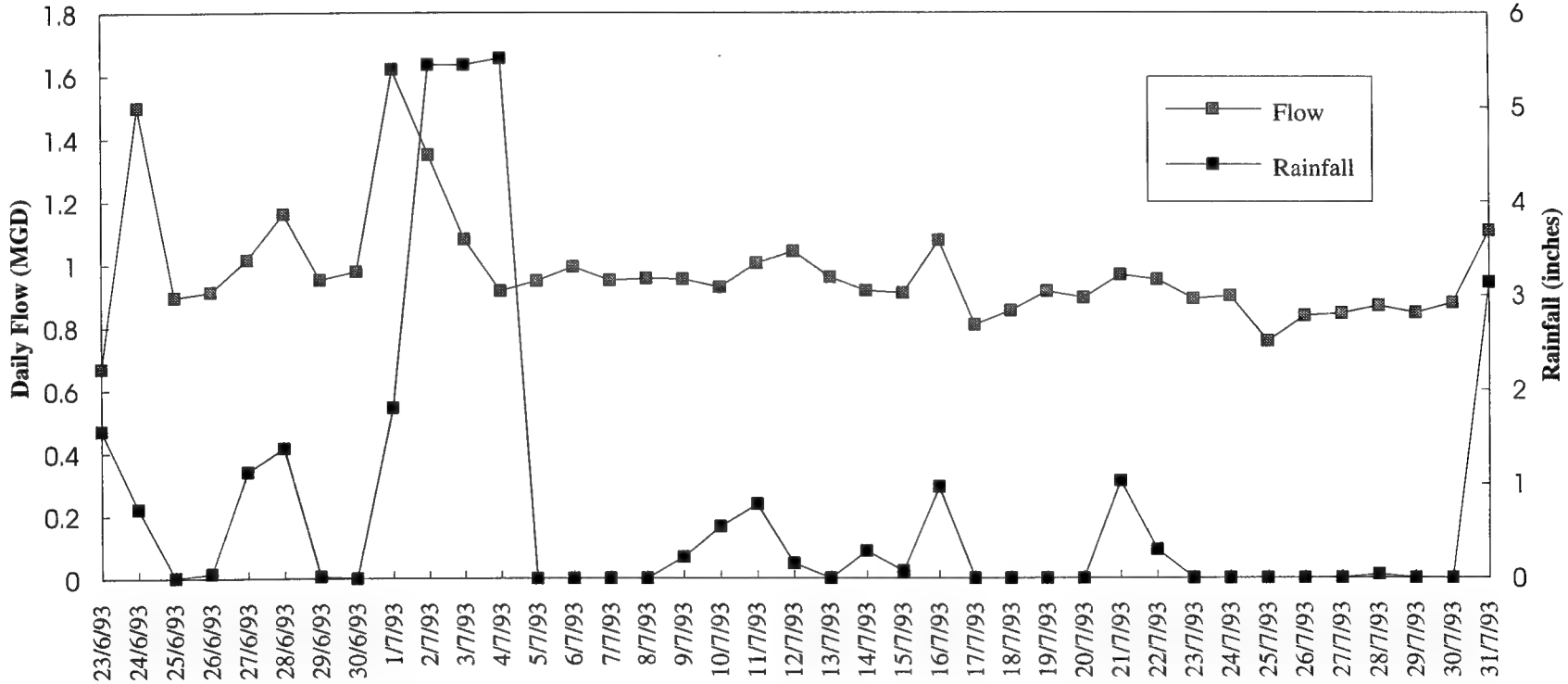
The Sheet Metal Shop (Bldg. 4) uses an oil-base solution for the band saws and cutting shears. Presently, all wastewaters are discharged to the sewer without pretreatment.

Figure 4.3. Flow and Rainfall Variation from October 1992 to September 1993, Howard AFB, Panama



AA011\Fig. 3

Figure 4.4. Daily Wastewater Flow and Rainfall Variations, June-July 1993, Howard AFB, Panama



AA011\Fig 4

The Pavements, Equipment and Grounds Shop generates and turns in approximately 110 gallons per year of waste oil, which is disposed of through a waste oil contractor. The vehicles are washed at the wash rack located next to Building 11. Wash waters drain to an oil/water separator prior to their discharge to the sanitary sewer.

The Civil Engineering Squadron (CE Supply) does not generate non-domestic wastes in their operation. Petroleum products in the CE supply system that exceed their shelf life are opened and disposed of through the local waste/oil recycle contractor.

The Chrysler Technologies Maintenance operation has changed the operating procedures and currently, no liquid wastes are generated in this facility.

The Corrosion Control Shop (Bldg. 241) is no longer in operation. Therefore, no wastes are generated in this area.

Lockheed operates a Corrosion Control Facility just outside Hangar #4. Painting and corrosion control activities for aircraft parts generate approximately 200 gallons of waste paint and related material. Wastewater generated at this facility is discharged directly to the sanitary sewer.

The Electro/Environmental Shop (Bldg. 256) is dedicated to servicing batteries. Small amounts of sulfuric acid solution (37%) are sometimes spilled when servicing batteries. The spilled solution is neutralized with sodium bicarbonate (baking soda) before it is flushed down the drain. All other battery wastes are disposed of by a hazardous waste contractor.

The AAFES Service Station performs minor maintenance on privately owned vehicles. This facility is provided with an oil/water separator to treat all wash waters generated in the maintenance operations. The separated oil flows into an underground storage tank, while the water is discharged to the sanitary sewer.

The Base Auto Hobby Shop is a recreational auto repair facility for privately owned vehicles. An oil/water separator intercepts the oily wastes generated by washing operations (e.g., garage floors and wash rack). The pretreated waste is discharged to the sanitary sewer.

The Air Intelligence Squadron Photographic Lab (Bldg. 723) develops various type of film, both black and white and color. Silver from the fixer photo processing solution

is presently recovered using Clayton-type filters. The spent fixer is then discharged to the sewer. The used developer is mixed with large amounts of water and flushed down the drain. Although the amount of liquid developer system cleaner used annually is low (approximately 48.5 gal/yr), this product is a source of chromium and is being discharged directly to the sewer. Also, cyanide is often a by product of photographic development and can have a inhibitory or toxic impact on the WWTP. The presence of cyanide should be further investigated and should be analyzed for semiannually in the WWTP influent, effluent and sludge.

Hangar #1 houses the U.S. Navy LOG DET Operations, and also has been designated as a hazardous wastes accumulation point. The accumulation point routinely contains paint waste (e.g., mixture of paint and paint thinners), waste oils and hydraulic fluids. All wash waters generated in this facility are discharged to the sanitary sewer.

Although there appears to be some potential problems with industrial waste entering the sanitary sewer system, no definitive conclusions can be reached with regard to impact by industrial wastewater on the WWTP. No data on influent, effluent and sludge for metals and organic priority pollutants exists at present. To further evaluate this situation the plant influent, effluent and sludge should be sampled and sent to Brooks AFB for metals and organics analyses. (1.4.1.7)

4.4 SUMMARY OF OPERATIONAL PROBLEMS IDENTIFIED

During the Phase I visit, the evaluation team identified a number of operational problems which have been discussed in Section 4 of this report. The following is a summary of the problems discussed in this section along with recommended improvements.

- The influent to the activated sludge system is currently being pumped. Although the influent pumps are variable speed pumps, the drives are not functioning correctly. The pulsating flow pattern created by intermittent pumping is detrimental to the operation of the biological system. It is recommended:
  - Repair the variable speed drives to improve the flow pattern throughout the treatment system,
  - Control the variable speed drives off a signal from the influent flow meter,

- Replace one pump with a unit small enough to correspond to the lowest flow during the 24-hour flow pattern.

- Although the plant personnel have attempted to implement a control strategy for the activated sludge process, they have had minimal success. We recommend maintaining a constant sludge retention time (SRT) for process control.

- The lack of flow metering devices in the sludge recirculation and wasting lines make it difficult to correctly operate the activated sludge system. Return and waste sludge flow data are critical for proper process operation of activated sludge plants. We recommend installing flow meters on both the sludge return and waste sludge lines.

- Sections of the weirs in both clarifiers are severely out of level. This has created short-circuiting currents and loss of the solids blanket at those locations. Therefore, we recommend leveling the weirs as soon as possible to reduce solids losses.

  Recent information obtained from the operating personnel confirms that sludge wash-outs were controlled in one clarifier after the weirs were leveled. The second clarifier has already been scheduled for maintenance.

- Sludge pumping from the secondary clarifiers should be controlled based on sludge concentration and sludge blanket depth measurements.

- An evaluation of the drying beds media should be performed to determine if sand and gravel replacement is necessary.

- An evaluation of the laboratory procedures, record keeping and quality control was performed by the evaluation team. A number of deficiencies were encountered in the laboratory evaluation that directly impact process operation of the plant. The major problem that should be addressed is the immediate need for a new muffle furnace so that the lab can produce volatile suspended solids data required for process control. A detailed discussion of the laboratory procedures followed at the plant is included in Section 6.

- Repair the influent flow meter recorder/totalizer.

- Change operation of the aerobic digester, basing sludge withdrawal to the drying beds based on percent volatile solids.

- The lead-lag status of pumps in the lift station should be alternated periodically to equalize service on the pumps and equalize maintenance related costs.
- The practice of surface disposal of grit and screenings on plant grounds should be discontinued because of possible health concerns. This material should be buried or taken to a sanitary landfill if available.

SECTION 5
PLANT MAINTENANCE

5.1 CONDITION OF EQUIPMENT AND HOUSEKEEPING

The overall condition of most of the equipment at the Howard AFB WWTP was good at the time of the Phase I Evaluation with some exceptions.

As mentioned in Section 4 of this report, the variable speed drives for the plant influent lift station were not functional. The influent flow meter chart recorder and totalizer were also out of service. The variable speed drives had apparently been out of service for a considerable period. The lack of variable speed drives has a definite negative impact on process operation of the activated sludge system. Currently, the pumps operate off wet well level. The pumps kick on and off as the wet well level varies, creating flow surges through the secondary system. Flow surges tend to promote poor sludge settling and solids carryover from the secondary clarifiers. As has previously been recommended, the influent pump station should be renovated including repair of the variable speed drives. Capacity of one of the pumps should be small enough to correspond to the lowest flows during the 24 hour flow pattern. Pump controls should be paced off the influent flow meter. The condition of the secondary clarifier weirs was not satisfactory during the evaluation. The weirs should be leveled as soon as possible. Since the Phase I Evaluation, the most severely uneven section of the weirs in both units were worked on by plant personnel. In telephone conversations with plant personnel, they indicated that clarifier performance has improved as a result of the weir leveling effort. The weirs on both units should be completely leveled. This will require support from civil engineering personnel including a transit for establishing consistent level around the weir circumferences. It will also require some new hardware such as bolts and in some places, new weir sections.

Two pumps were observed to be out of service during the visit to the lift stations. One of the pumps in Lift Station No. 1 was out of service due to a bad motor that needed replacement. A check valve and a mag-starter were being replaced on one of the pumps in Lift Station 718.

A housekeeping review of the plant, grounds and buildings, and the lift stations was conducted during the evaluation. These areas all were in excellent condition and no recommendations are forthcoming on these areas. (1.4.1.7)

5.2 PLANT MAINTENANCE PROGRAM

A Base-wide preventive maintenance program (Recurring Work Program) is established and is implemented for the WWTP. A computer list of equipment requiring maintenance, or Recurring Work Program Report (RWPR), is produced weekly. This report provides an equipment identification number, maintenance frequency, description of work, estimated and actual hours necessary to perform the activity, and status of work (see Figure 5.1). The RWPR serves as both a work order, and when the work is completed, a report on the work done. It is sent back to Civil Engineering where the computer record is updated. Items on the RWPR not finished that week will continue to appear on subsequent RWPRs until they are completed. In addition to the RWPR, a maintenance action sheet (MAS) is prepared for each piece of equipment requiring maintenance. The MAS contains a list of activities to be performed, the amount of time allocated per activity, the frequency of the activity and the size of the crew needed (see Figure 5.2).

An adequate supply of spare parts is kept on hand including bearings, seals, packing glands, chlorinator parts and various couplings and plastic pipe joints. There are also extra motors and valves for critical process operations and lift stations. The plant has a portable electric generator for keeping lift stations on-line during power problems. However, the plant lacks a formal spare parts inventory and control system to ensure spare parts are available when needed and are ordered when depleted. A spare parts inventory should be developed. Forms for an example spare parts inventory system will be included in the O&M manual.

One problem that was observed with maintenance supplies was the lack of grease. Plant personnel indicated that it is very difficult to procure grease through normal procurement channels. The process needs to be improved to ensure that there is always an adequate supply of grease on hand.

Date 07/27/93 Recurring Work Program Report Program = MRWPRPTS
Page 68 All work scheduled for the week ending 930801 Version = 4.04.000.009 91/01/29
For Shop 469

Frequency / Req Type	Equip Ix/Nr	FacNr / MC Nr	Description of Work / Location	EstHrs / ActHrs	WAS	Crit / MxEq	CrSz / Dav	WIn / Ilo	Strt / Sign	Prog Status	Dt Sch / DtPerf	Remarks
Monthly	4	1	CHECK LIFT STATION	1.0		N	1	01			930801	
Equipment	5	05001	LIFT STATION 1 HOWARD	0.0	1	N	Thu	01		Scheduled	930712	
Monthly	4	8	CHECK LIFT STATION	1.0		N	1	01			930801	
Equipment	4	00208	LIFT STATION 8 HOWARD	0.0	2	N	Thu	01		Scheduled	930712	
Monthly	6	40	CHECK SWIMMING POOL	2.6		N	1	01			930801	
Equipment	2	03040	SWIMMIN POOL HOWARD	0.0	11	N	Fri	01		Scheduled	930712	
Monthly	4	49	CHECK LIFT STATION	0.6		N	1	01			930801	
Equipment	1	00049	LIFT STATION, 49	0.0	8	N	Thu	01		Scheduled	930712	
Monthly	4	225	CHECK LIFT STATION	0.6		N	1	01			930801	
Equipment	2	00225	LIFT STATION, 225	0.0	7	N	Thu	01		Scheduled	930712	
Monthly	4	608	CHECK LIFT STATION	0.6		N	1	01			930801	
Equipment	6	00608	LIFT STATION 608 ALBROOK	0.0	4	N	Thu	02		Scheduled	930701	
Monthly	4	609	CHECK LIFT STATION	0.6		N	1	01			930801	
Equipment	7	00609	LIFT STATION 609 ALBROOK	0.0	3	N	Thu	02		Scheduled	930701	
Annual	7	692	CLEAN WATER TANKS	1.0		N	2	01			930709	
Equipment	2	00692	692-693	1.5	17	N	Wed	01		Working	930715	
Monthly	4	718	CHECK LIFT STATION	1.0		N	1	01			930801	
Equipment	3	00718	LIFT STATION 718 HOWARD	0.0	5	N	Thu	01		Scheduled	930712	
Monthly	6	849	CHECK SWIMMING POOL	2.8		N	1	01			930801	
Equipment	1	10849	SWIMMING POOL ALBROOK	0.0	12	N	Thu	02		Scheduled	930701	
Monthly	5	889	CHECK RECIRCULATING PUMP	2.1		N	1	01			930801	
Equipment	2	00889	WATERWASTE PLANT HOWARD	0.0	9	N	Thu	01		Scheduled	930715	
Monthly	5	895	CHECK INFLUENT PUMP STATION	0.6		N	1	01			930801	
Equipment	1	01895	WATERWASTE PLANT HOWARD	0.0	8	N	Thu	01		Scheduled	930715	
Monthly	4	949	CHECK LIFT STATION	1.0		N	1	01			930801	
Equipment	5	00949	LIFT STATION 949 HOWARD	0.0	6	N	Thu	01		Scheduled	930712	

Total Estimated Hours for this Shop - 15.5
Total Actual Hours for this Shop - 1.5
Number of RWP Records for this Shop - 13
This report was sorted by - Shop, Facility, Equip Type

Figure 5.1

MAINTENANCE ACTION SHEET	COST CENTER	DESCRIPTION	MAS NUMBER
	469	Check Swimming Pool	0012

REQUIRED MAINTENANCE ACTIONS	REFERENCE	STANDARD HOURS	FREQ.	CREW SIZE	HEAVY EQP
Facility #849	AFM 85-59				
1. Check Recirculating pump and motor for proper operation.	71506	.094	M	1	N
2. Clean chlorinator and check for signs of deterioration due to CL2 leak.	75110	.044	M	1	N
3. Lubricate motors as required.	75116	.269	M	1	N
4. Check sump pump for leaks, unuasual noise, lubricate as required.	75117	.269	M	1	N
5. Check clorine gas mask for frayed or worn parts, proper fit & leaks clean.	75119	.015	M	1	N
SUBTOTAL=		691			
TRAVEL TIME =		.25			
TOTAL=		.941			

DATE	WCF INITIALS	DATE	SUPERINTENDENTS INITIALS

AF FORM JUL 72 1841

Figure 5.2

SECTION 6
LABORATORY AND SAMPLING PROGRAM

6.1 SAMPLING SCHEDULE

Table 6.1 presents the current sampling and analysis schedule for the Howard AFB WWTP. The schedule includes samples taken for effluent compliance and for plant process control. The schedule provides a frequency of sampling and analysis for each parameter, as well as where the individual parameter is analyzed. Currently, all parameters are analyzed at the Howard AFB laboratory. The O&M manual will include procedures for recommended modifications to the current sampling and analysis procedures and schedule (1.4.1.5).

6.2 LABORATORY PROCEDURES

During the Phase I site visit, the ES evaluation team undertook an evaluation of the laboratory procedures which are performed at the Howard WWTP laboratory to ensure that self-monitoring data generated is produced in accordance with approved procedures. The operators use a set of step-by-step procedures for analysis of BOD, TSS, and Fecal Coliform and pH. Generally, the operators are performing lab analyses in accordance with the lab's written procedures. However, some parts of these procedures require modification, as will be noted in the discussions which follow. The written procedures will be modified and updated in the site-specific O&M manual (1.4.1.5).

6.2.1 Sampling Procedures

The Howard AFB WWTP utilizes composite sampling of the influent and effluent. Samples are collected manually and composited according to flow. Individual samples are collected every two hours for 16 hours. Samples are not collected on the third shift. Instantaneous flow measurement readings are taken when the samples are collected to determine the volume of sample to be placed in the composite sample reservoir. Sample collection and sample reservoir containers are plastic. The composite sample reservoirs

TABLE 6.1

HOWARD AFB WASTEWATER TREATMENT PLANT
SAMPLING SCHEDULE

Parameter	Frequency	Laboratory	Guidance Document Requirement
Influent BOD	2/week	WWTP	Yes
Final Effluent BOD	2/week	WWTP	
Stream Above (0.5 miles) BOD	1/week	WWTP	
Stream Below (1.0 miles) BOD	1/week	WWTP	
Stream Below (1.5 miles)	1/week	WWTP	
Influent TSS	Daily	WWTP	
Aeration Tanks TSS	Daily	WWTP	
Return Sludge TSS	Daily	WWTP	
Final Effluent TSS	Daily	WWTP	
Aeration Basins Settleable Solids	Daily	WWTP	
Return Sludge Settleable Solids	Daily	WWTP	
Final Effluent Setteable Solids	Daily	WWTP	Yes
Effluent Dissolved Oxygen (D.O.)	Daily	WWTP	
Stream Above (0.5 miles) (D.O.)	1/week	WWTP	
Stream Below (1.0 miles) D.O.	1/week	WWTP	
Stream Below (1.5 miles) D.O.	1/week	WWTP	
Aeration Tank D.O.	Daily	WWTP	
Influent pH	Daily	WWTP	
Effluent pH	Daily	WWTP	Yes
Influent Temperature	Daily	WWTP	
Effluent Chlorine Residual	Daily	WWTP	
Digester Total Solids	2/week	WWTP	
Effluent Fecal Coliform Bacteria	Daily	WWTP	*

* Fecal Coliform is not a Overseas Environmental Baseline Guidance Document requirement but was strongly recommended as the result of an ECAMP inspection.

are kept in the lab refrigerator during the collection period and prior to analyses. The influent sample location is representative of the wastewater being treated. However, the effluent sample was being collected after the point of chlorination. This sample is not representative of the effluent solids being discharged from the activated sludge system. Also, if this sample is utilized for Biochemical Oxygen Demand analyses, a dechlorination and reseeding procedure needs to be established. It was recommended during the evaluation that a new sample location be established by tapping into the secondary clarifier effluent line just prior to its entry into the chlorine contact chamber. (1.4.1.5)

6.2.2 Biochemical Oxygen Demand (BOD)(1.4.1.5)

A number of procedural items were observed during the BOD analysis that were less than optimal, or were not in accordance with acceptable BOD test procedures.

1. The chlorinated sample used for effluent BOD analysis must be dechlorinated and reseeded prior to setting up sample dilutions. This is a requirement of the test procedure as it is written in Standard Methods for The Examination of Water and Wastewater (Standard Methods). Without dechlorinating and reseeding, the final BOD determination is not considered a viable analysis.

2. The dilution water and samples should be equilibrated to near 20°C prior to setting up the dilutions. The dilution water should be stored in the bottom of the BOD incubator and the samples left out at room temperature for 1-2 hours prior to initiating the test.

3. A standard analysis should be run at least 10 percent of time to ensure the accuracy of the analysis for BOD. The two most common standards analyzed for BOD are glucose-glutamic acid and potassium acid phthalate.

4. A new procedure needs to be established for calibration of the Dissolved Oxygen (D.O.) Meters. The procedure was discussed with plant personnel during the Phase I Evaluation and a written procedure will be included in the O&M Manual.

5. A record of all D.O. meter calibrations should be maintained in the lab. The meter calibration record should include the date, check-offs for redline and zero, calibration method used, temperature, D.O. set point and the initials of the analyst.

6. The calibration of the D.O. meter should be checked after sample readings are made to ensure that calibration is maintained within 0.1 mg/L.

7. In reviewing previous bench data for the BOD test, it was observed that dilution water blanks had 5-day oxygen depletions greater than the maximum allowable 0.2 mg/L. The source of this problem needs to be investigated and eliminated to ensure that D.O. depletions in all bottles are attributable to the sample dilution and not a problem with the dilution water.

8. Three dilutions are being set up for each sample. The dilutions do not always yield the proper D.O. drop of 2.0 mg/L or the final D.O. criteria of 1.0 mg/L remaining. In those instances, only the dilutions meeting those criteria should be utilized in calculating the BOD value.

9. A laboratory thermometer should be kept inside the BOD incubator, immersed inside a beaker of water, to ensure that the temperature of the incubator is being maintained at 20°C ± 1°C. A daily temperature record should be maintained for the BOD incubator. A copy of an example temperature record is included in Appendix B of the report.

10. The bench sheets used for BOD should provide information on the methodology from the latest edition of Standard Methods. (18th Edition currently in use.) See Appendix B for a copy of an example bench sheet.

6.2.3 Total Suspended Solids (1.4.1.5)

During the analysis of TSS, the following items were observed which need to be addressed to ensure that the procedure adheres to all test requirements and protocols.

1. The required temperature of the oven is 103°-105°C. A thermometer should be inserted into a beaker of sand inside the oven so that stable readings of the interior of the unit are monitored.

2. A temperature record should be maintained on the drying oven, including the date, temperature reading, and the initials of the analyst.

3. A distilled water blank should be run 10 percent of the time to ensure the precision of the TSS analysis.

4. The analytical balance should be serviced once per year by a manufacturer's representative or by qualified technical personnel. A record should be

maintained of this service and any calibrations using laboratory weights by lab personnel.

5. The current procedure utilized in running suspended solids on the aeration basin contents includes straining out of large solids prior to filtering the sample. This practice should be eliminated. The mixed liquor analysis should include all constituents of the aeration basins.

6. The lab should be equipped with an inexpensive lab timer to ensure that the various solids testing procedures are performed in accordance with required time periods.

7. During the evaluation, it was noted that the current muffle furnace was very old and was reported to be functioning improperly. The temperature controls of the unit were not working. Due to the age and condition of the unit, it is recommended that a new muffle furnace be procured for the laboratory. This is a critical piece of lab equipment in terms of plant process testing and control. For the plant to utilize sludge retention time (SRT) as the primary process control parameter, the muffle furnace is imperative.

8. The bench sheet for suspended solids needs amending to include spaces to record all raw data for the test including the weight of crucibles or filter, weight of the crucible or filter plus residue, the weight difference and the final result. The bench sheet should also include reference to the latest edition of Standard Methods (i.e., 18th Edition), a space to record the date and time of the analysis and a signature block for the analyst. An example bench sheet is included in Appendix B of this report.

6.2.4 Fecal Coliform Bacteria (1.4.1.5)

During the analysis of the plant effluent for fecal coliform bacteria, the following items were observed which should be addressed to ensure that the test procedure adheres to all test requirements and protocols.

1. The required water bath incubator for the fecal coliform bacteria test is 44.5 ± 0.2°C. At the time of the evaluation, the temperature of the incubator was within this criteria. A record must be kept of the water bath temperature on each day that the unit is in service as part of the raw data kept for the test.

2. In addition, a record must be kept of the time and temperature for each sterilization cycle. A fifteen minute sterilization period after the pressure cooker reaches 121°C is required.

3. A temperature daily record must be maintained of the refrigerator where samples and media are stored.

4. The sample bottles used to collect samples for fecal coliform bacteria are an incorrect type. Standard bacteriological dilution bottles should be obtained for this purpose.

5. Sterile, buffered dilution water must be prepared and used during the analysis. The dilution water is a critical component of this test. It is normally used to set up a sterile blank and to rinse the funnel and filter after filtration of samples.

6. At least three dilutions should be set up for each sample tested.

7. A known positive sample is normally analyzed to ensure the viability of the test procedure and culture media.

8. Membrane filters should be handled with sterile forceps. In order to ensure sterility of the forceps, they should be sterilized in the pressure cooler along with the other test equipment. In addition, a small alcohol burner should be obtained and used during the test to resterilize the forceps between handling of membrane filters.

9. Denatured alcohol used for the alcohol burner should also be used to wipe down the entire counter work area prior to initiating the fecal coliform bacteria test.

10. Data sheets kept for the fecal coliform test should include the following information.

    - Date and time samples put in water bath
    - Date and time samples removed from water bath
    - Analyst's initials or name
    - Procedure used
    - Colony counts for all dilutions
    - Sample volume for each dilution
    - Fecal coliform per 100 ml for each dilution

An example bench sheet is included in Appendix B of this report.

6.2.5 pH (1.4.1.5)

1. A major concern with regard to the pH analysis is that pH must be run on samples immediately after collection. pH analysis requirements mandate that holding time be kept near zero. This of course does not permit pH analysis on composite samples unless that analysis is for internal purposes.

2. When running pH samples, a record must be kept of the sample temperature, sample pH, the date and analyst.

3. A record should be maintained of pH meter calibrations including the pH value of the buffers used, the temperature of the buffers, the date and analyst.

6.2.6 Dissolved Oxygen (D.O.) (1.4.1.5)

1. Field D.O. readings in the aeration basins should, on a regular basis, (i.e., monthly) be taken at several different locations and depths throughout the basin to obtain profiles of the basin D.O. This will require procurement of a 50-foot cable/probe and the fabrication of a hand held boom to safely lower the probe into the basin at different locations. The boom can be a PVC, heavy gauge pipe with eyelets fastened along its length. The cable will need to be graduated in one-foot increments.

6.3 ADDITIONAL SLUDGE MONITORING

During the Phase I Evaluation, the need for additional sludge monitoring points or parameters was identified.

6.3.1 Aeration Basin

Currently, mixed liquor suspended solids are being run on each of the aeration basins and the return activated sludge. The volatile portion of these samples also needs to be determined each time the MLSS is run once a muffle furnace is obtained. The MLVSS data is needed for calculation of SRT.

6.3.2 Aerobic Digesters

Currently, total solids are being run on the digesters. To adequately control these unit processes, volatile solids also need to be analyzed.

SECTION 7
RECORD KEEPING

7.1 EVALUATION OF PLANT RECORDS (1.4.1.3)

During the Phase I visit, the ES team evaluated the following records:

- Water Pollution Control Plant Operating Logs
- Plant Standard Operating Procedures
- Equipment Manufacturers Manuals
- Equipment Preventive Maintenance Schedules
- Plant Log Book
- Laboratory Sampling Record
- Laboratory Bench Sheets, and Calibration Records
- Safety Records
- Plant As-built Drawings

In examining the Water Pollution Control Plant Operating Logs and Supplemental Logs for the twelve months prior to the evaluation, some logs were not available and the maintenance of these records was disorganized. Eventually all the logs were found except one month which had to be recreated. This points out the need for improved organization in record keeping which the evaluation team observed in several aspects of plant O&M.

The equipment manufacturer's manuals are kept at the plant in file drawers in the NCOIC's office. Not all the information was readily available during the evaluation. The system of vendor's literature also needs organization in the file drawers for easy and quick access.

Equipment preventive maintenance schedules are maintained in the base computerized maintenance management system. The system, known as the Recurring Work Program (RWP), generates a weekly report called Recurring Work Program

Report (RWPR) which is a listing of equipment items requiring maintenance that week. Each item has an equipment number. The RWPR draws from the master preventive maintenance schedule for items requiring maintenance on a particular week. The RWPR gives a description of the required work, the estimated hours to complete the task and spaces for information once the work is completed which are used to update the maintenance database.

Another important aspect of the maintenance record keeping is the Maintenance Action Sheets (MAS). When a RWPR is generated for an equipment item, the operator or maintenance mechanic can refer to the MAS for that item and receive a detailed listing of required work tasks to be completed and the hours and crew size required to complete the task. Refer to Figure 5.1 and 5.2 for examples of RWPRs and MASs.

One deficiency noted in the maintenance record keeping system is the lack of a spare parts inventory and control system. The WWTP spare parts on-hand appeared adequate but there was no record of what was available or a system for controlling the flow of spare parts. Example spare parts inventory and control forms that could be utilized at the WWTP are illustrated in Figures 7.1 and 7.2.

The WWTP currently maintains a chronological logbook for daily activities at the plant. It has been ES's experience that this is not the best way to keep daily records. We favor use of plant daily operating logs organized by unit process or daily checklists. These systems make it easier to trace the origin of plant and equipment problems. One of the systems should be adopted. A plant-wide operating log or checklists will be developed for the O&M manual in conjunction with the plant staff.

The laboratory records examined require some upgrading to comply with the usual documentation maintained in WWTP laboratories.

- A record should be maintained of all meter and balance calibrations.
- Temperature logs should be maintained for all ovens, incubators and refrigerators associated with lab analyses.
- The bench sheets for total suspended solids should be amended to include all required raw data collected during the analyses.

SPARE PARTS RECORD

Order		Item			Received		Issued			Number	Inventory
No.	Date	Quantity	Description	Cat. No.	Date	Cost	Date	Quantity	Index No.	In Stock	Date & Initial

SPARE PARTS RECORD FORM

Figure 7.1

SAMPLE INVENTORY CARD

STOREROOM INVENTORY CARD

Item Description -

Item No. _____

Isle No. _____

Bin No. _____

Quantity Maximum _____ Minimum _____

Reorder _____

INVENTORY INFORMATION

Quantity Used or Stocked	Date	Signed	Quantity on Hand	USAGE OR SUPPLY INFORMATION Usage - Work Order No. Supply - Purchase Order No.

- A bench data sheet needs to be initiated for the Fecal Coliform Bacteria analyses.
- A bench data sheet should be kept for pH analyses.

Please refer to Sections 6.2.2 through 6.2.5 for a more detailed discussion of the requirements of these bench data sheets. Example bench data sheets for BOD, TSS, Fecal Coliform Bacteria and pH are included in Appendix B of this report.

Since most safety records such as accident reports, safety training records, etc. are kept at locations other than the WWTP, it was not possible to evaluate all those. These records are kept in the normal Air Force format. There may be some benefit to keeping duplicates of the most important records at the WWTP such as individual accident reports, training records, hazard reports and daily safety checklists. Also, a record should be initiated of the weekly safety briefings conducted by the NCOIC at the WWTP.

The WWTP had a relatively complete set of as-built plans which are maintained at the control building office.

SECTION 8
SAFETY

8.1 PLANT SAFETY PROGRAM

The WWTP safety program has a number of provisions for promoting a safe work environment and to prevent accidents. Many of the provisions are part of or an extension of the Air Force's safety program. These provisions include training, procedures and equipment.

Training includes first aid for all civilian employees and both first aid and CPR for military personnel. Military personnel also receive hazard communication training (HAZCOM). Safety briefings are performed by the NCOIC at the WWTP during the weekly staff meeting. Most records of safety training are kept on-base in individual personnel files. The plant does not maintain a record for safety briefing topics covered at the plant. The Fire Protection Branch provides initial and periodic training to plant personnel on the use and maintenance of the plant's self contained breathing apparatus and the three chlorine repair kits located at the WWTP and swimming pools. Records of this training are kept in personnel files.

Safety procedures are based on the AFOSH Safety Standards. A work place hazard analysis of the WWTP and related job tasks has been performed. From this, specific safety procedures have been developed. Procedures for safe handling of chlorine gas cylinders, changing chlorine gas cylinders, working around open tanks, chemical handling, working around operating mechanical and electrical equipment are included in the job hazard analysis. A listing of personal protective equipment for WWTP employees has also been developed and implemented. Each employee has safety items or has access to items such as safety toe shoes, face and eye protection, rubber gloves, aprons and boots, gas masks and respirators. A procedure for inspection of all respirators is in place. A daily safety checklist is used for the WWTP, lift stations and swimming pool areas. A list of fifteen safety related questions are answered yes or no. Also, emergency procedures are provided for fire reporting, personnel evacuation, personnel injury, etc. A procedure is provided to identify and report hazards using AF Form 457,

Hazard Report. Detailed procedures for reporting on-the-job injuries to the Civilian Personnel Officer are provided including completion of Form CA-1 and referring an employee to the Base Dispensary. Detailed operation and maintenance procedures are also provided for the self contained breathing apparatus including cleaning, disinfection and storage. Finally, a procedure is provided for an emergency chlorine leak which includes reporting and evaluation. Directions on the use of the chlorine repair kits are located inside the repair kit boxes.

Safety equipment located at the plant includes self contained breathing apparatus (SCBA) mounted on the chlorine feed building. An additional SCBA unit is available for outlying locations. Fire extinguishers are located in the following buildings:

- RAS/WAS Pump Station
- Control Building
- Chemical Storage Building
- Bench Stock Storage Area
- Corrall

The plant has safety signs posted prominently around the plant including "Ear Protection Required," "No Smoking" and "Danger Chlorine." There is one eyewash/emergency shower located at the Control Building. Life rings are mounted on the aeration basins, secondary clarifiers and the aerobic digesters. The plant does not have a combustible gas/oxygen meter available for safe entry into vaults, wet well or areas where oxygen could be deficient. This meter is fairly standard safety equipment in waste waster treatment operations. (1.4.1.7)

8.2 ADDITIONAL SAFETY NEEDS

Overall, the WWTP safety program was found to be very comprehensive and well documented. The only items that came to the attention of the ES evaluation team that need to be addressed are as follows:

- The storage location of the self contained breathing apparatus is too close to the chlorine feed tanks and equipment. In the event of a chlorine leak, this close proximity could prevent personnel from being able to get to and deploy the breathing apparatus. The SCBA could possibly be mounted on the inside wall of the influent pump station building.

- An additional safety shower/eyewash station should be installed in the same location described above. In the event of personnel receiving a dose of chlorine, a shower/eyewash for flushing eyes and skin should be much closer than the control building.
- Safety briefings provided during the weekly staff meeting should be documented including the topic discussed and the persons attending the meeting.
- A life ring should be provided in the area of the influent pump station wet well and grit chamber.
- A combustible gas/O_2 meter should be available for plant personnel to utilize in entry into lift station, chlorination vaults or rooms at the plant or swimming pools or any area where O_2 might be deficient. This may be a particularly important safety issue at Lift Station 735 while ventilation improvements are being made.

SECTION 9
CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS

The following conclusions have been reached as a result of the Phase I visit, document reviews and continued communication with WWTP personnel.

1. Although plant records indicate that the plant is fairly consistently meeting the Overseas Baseline Guidance Document Criteria for WWTP discharges, there is room for improvement in both the effectiveness of the process operations and laboratory measurement of the discharge.

2. There are a number of areas where improved process operation and/or monitoring needs to be implemented. These areas are influent wastewater pumping, activated sludge process control strategy, return and waste activated sludge pumping control, secondary clarifier operations and drying bed operations.

3. Several areas of laboratory operation and record keeping need improvement to ensure that all self-monitoring data is generated in accordance with accepted procedures and protocols.

4. The WWTP maintenance program which utilizes the computerized, base-wide Recurring Work Program seems very comprehensive. Although only a small part of the documentation for this program was actually observed, it appears to be fully implemented.

5. The plant staff, especially the civilian side is very experienced in WWTP operations. There are no operator certification requirements in Panama and thus little training required outside on-the-job-training. The Merit System standard for the Wastewater Treatment Plant Operator position should be upgraded to include a training standard to ensure that operators receive some formal training in wastewater treatment.

6. Staff size does not appear to be a problem relative to size and complexity of the WWTP. However, activated sludge plants should be manned 24 hours per day. Because of security concerns, two persons per shift are normally required at the WWTP. Placing two persons on the third, currently unmanned shift, would create manpower problems. The base should either improve security at the WWTP so that the night shifts can be manned by one person or allocate additional military personnel to the WWTP.

7. Overall management of the WWTP is effective. The one thing that would improve the situation is to have the NCOIC at the WWTP receive technical training in wastewater treatment. TSgt. Mourning is very conscientious, hard working and has the respect of the WWTP staff. He or any future NCOIC will be a more effective manager of the WWTP as their technical knowledge of wastewater treatment improves.

8. The issue of whether toxic industrial wastewater may be having a deleterious effect on WWTP operations requires further data for evaluation. Semi-annual analyses of the plant influent, effluent and sludge for metals and toxic organic pollutants should be performed.

9. Plant record keeping needs improvement in overall organization and in laboratory analyses. The WWTP should initiate use of an operational log or daily plant checklists.

10. The plant safety program for the most part is excellent. A few small improvements are needed with regard to equipment.

9.2 RECOMMENDATIONS

Table 9.1 presents recommendations for optimizing operation, maintenance, process control, and laboratory functions at the WWTP. Broad cost estimates for implementing the recommendations are also included where possible.

TABLE 9.1
HOWARD AFB WASTEWATER TREATMENT PLANT
SPECIFIC RECOMMENDATIONS AND
ESTIMATED IMPLEMENTATION COSTS

	Recommendation	Comments/Significance	Estimated Cost of Implementation
1.	Implement a process control strategy for the activated sludge process based on maintaining a constant sludge retention time (SRT).	Raw data required for the calculation of SRT includes MLVSS, aeration basin volume, WAS VSS, effluent flow effluent TSS and WAS flow.	See items 2 and 3.
2.	Procure a new muffle furnace with adequate temperature monitoring and control so that volatile suspended solids can be run for process control.	Required temperature for volatile solids or volatile suspended solids is 550°C ± 50°C.	$2,000
3.	Install flow meters on RAS and WAS lines to have reliable flow data for process control of activated sludge system.	RAS system - 8" mag meter. WAS system - 4" mag meter.	This is a design/upgrade item which will require engineering design services to determine accurate cost estimates.
4.	Establish a new effluent sampling location for total and volatile suspended solids prior to the chlorine contact chamber.	Possibly tap into the secondary clarifier effluent line just ahead of the chlorine contact chamber.	$100
5.	Level the secondary clarifier weirs to reduce short circuiting and solids carryover.	Will require support from civil engineering squadron personnel. Will require new hardware.	$200
6.	Obtain additional analytical data on the wastewater treatment plant influent, effluent and sludge.	• Metals and toxic organics semiannually on the influent, effluent and sludge. • COD, TKN and total phosphorous on the influent monthly for six consecutive months.	$1,200 for commercial lab services $420 for commercial lab services
7.	Upgrade the influent pump station/controls to provide variable speed drives and flow pacing off the influent flow meter.	Forward flow to the plant should not be intermittent as is presently the case.	This is a design/upgrade item which will require engineering design services to determine accurate cost estimates.
8.	A plant-wide daily operations log or daily plant checklists should be implemented to ensure that all operator duties are completed each day and a record is maintained of plant operations.	A daily log or operator checksheets will be developed for the O&M manual.	No cost.

TABLE 9.1 - Continued
HOWARD AFB WASTEWATER TREATMENT PLANT
SPECIFIC RECOMMENDATIONS AND
ESTIMATED IMPLEMENTATION COSTS

Recommendation	Comments/Significance	Estimated Cost of Implementation
9. A formal training requirement should be implemented for all employees in the Wastewater Treatment Plant Operator classification.	"Operation of Wastewater Treatment Plants" offered by California State University could be utilized as a course for operators at Howard AFB.	$100 per operator.
10. The WWTP should be staffed 24 hours per day. The third shift (2400 Hours - 0800) should be manned as soon as arrangements can be made to provide additional operators or to provide a security fence.	Process observations and adjustments should be made around the clock by plant personnel at activated sludge plants.	$15,000 for security fencing around plant. $23,000 annually for salary plus fringe benefits for a WWTP operator.
11. Improve the overall organization of plant filing system.	Make all information readily available and accessible.	Staff time - no cost.
12. Purchase reference/self-study material listed in Section 3 of this report for the WWTP.		$400
13. Provide additional technical training opportunities for the current and future NCOIC of the WWTP.	Technical knowledge is necessary for effective WWTP management.	$1,000 - $2,000 annually depending on course and location.
14. Improve ventilation in Lift Station 735 through installation of exhaust fan and/or louvered windows.	Hydrogen sulfide gas build up evident during evaluation.	$1,000 - $1,500
15. Implement contract to repair/renovate aeration header line as soon as possible.	TSgt. Mourning indicated on December 20, 1993 that this work was scheduled for early January.	N/A - Recommendation not initiated by ES Evaluation Team.
16. Maintain a dissolved oxygen (DO) residual of 2.0 mg/l throughout aeration basins.	To ensure adequate D.O. for microbial activity.	Normal operating costs.
17. Control of the aerobic digesters should be established based on percent reduction of volatile solids. Reduction in volatile solids should be greater than 40 % prior to drawing sludge to beds.	Percent reduction in volatile solids should be greater than 40 prior to draining sludge to drying beds.	No cost other than purchasing a muffle furnace.

TABLE 9.1 - Continued
HOWARD AFB WASTEWATER TREATMENT PLANT
SPECIFIC RECOMMENDATIONS AND
ESTIMATED IMPLEMENTATION COSTS

Recommendation	Comments/Significance	Estimated Cost of Implementation
18. Sludge should be drawn to the drying beds no greater than 8-12 inches in depth. If reducing depth does not improve dewatering, an evaluation of the drying bed media should be performed to determine if sand and gravel replacement is needed.	8-12 inches promotes rapid dewatering of sludge and facilitates removal of sludge from the beds.	None initially.
19. Repair influent flow recorder/totalizer.	Troubleshooting and diagnosis required by manufacturer's representative to obtain estimate of repair/replacement cost.	Cost unknown.
20. The WWTP should develop a written spare parts inventory.	To ensure that spare parts are available when needed and ordered when depleted.	None.
21. The base should help expedite the procurement of maintenance supplies such as grease.	To ensure that there is an adequate supply on hand at all times.	None.
22. Chlorinated samples used for BOD analysis must be dechlorinated and reseeded prior to setting up sample dilutions.	This is a requirement of the test procedure as specified in standard methods.	None.
23. Amend lab monitoring procedures per discussions in Section 6.2.2 - 6.2.5.	• BOD • TSS • pH • Fecal Coliform	None.
24. Amend lab record keeping in accordance with Section 6.2.2 - 6.2.5.	• Temperature Logs • Calibration Records • Bench Sheets	None.
25. Run D.O. profiles in the aeration basins monthly.	Refer to Section 6.2.5.	$150 for new D.O. probe/cable.

TABLE 9.1 - Continued
HOWARD AFB WASTEWATER TREATMENT PLANT
SPECIFIC RECOMMENDATIONS AND
ESTIMATED IMPLEMENTATION COSTS

Recommendation	Comments/Significance	Estimated Cost of Implementation
26. Initiate volatile solids analyses on the aeration basins and aerobic digesters each time total or total suspended solids are analyzed.	Aeration Basins - TSS Digesters - % Total Solids	None.
27. Implement improved record keeping and file organization for WWTP records.	• Manufacturer's Literature • Lab Bench Data Sheets • WWTP Log and Supplemental • Daily Log or Checklists	None.
28. Change the storage location of the SCBA to a point that would be accessible during a chlorine leak.	Possibly the inside wall of the influent pump station building.	Minimal cost.
29. Install an additional safety shower/eyewash in the same location as the SCBA.	Possibly the inside wall of the influent pump station building.	$500.00
30. Document weekly safety briefings.	Include topic(s) discussed and person attending.	None.
31. Provide life rings in the area of the grit chamber and influent wet well.	The nearest life ring to this area is currently on the aeration basins.	$50.00
32. The lead-lag status of the lift station pumps should be manually alternated	Monthly	None
33. Grit and screenings should be buried or disposed of in a santary landfill if available.	Surface disposal is a potential health hazard.	None
34. Provide a combustile gas/O_2 meter for plant personnel.	Safe entry in lift stations, chlorine rooms, etc.	$1500

UNIVERSITY OF FLORIDA

TREEO CENTER

Environmental Training Calendar

FALL 1993

University of Florida
TREEO Center
3900 SW 63rd Boulevard
Gainesville, FL 32608-3848
904/392-9570
FAX 904/392-6910

1993/1994 Environmental Training Courses

Date	Prog#	Fee	Title
NOVEMBER			
11/15-18	#4203	$595	Activated Sludge Process Control: Think Microbiologically
11/15-19	#4010	$825	Asbestos Abatement: Project Management and Supervision
11/17-19	#4023	$350	Solid Waste Operators Short School
11/30	#4008	$135	Asbestos Abatement Refresher: Facility Survey
11/30	#4006	$265	Asbestos Abatement Refresher: Facility Survey and Management Planning
DECEMBER			
12/1	#4004	$265	Asbestos Abatement Refresher: Project Management and Supervision
12/6	#4037	$295	Understanding the Planning and Training Requirements of the Big Three
12/7-9	#4129	$595	Confined Space Entry Procedures
12/7-10	#4038	$745	Train-The-Trainer for Environmental Health and Safety
JANUARY			
1/10-11	#4195	$295	Advanced Course for Recycling Professionals: Commercial/Institutional Recycling (ORLANDO)
1/11-13	#4131	$445	Chlorine Safety Technician Training and Certification
1/12	#4234	$265	Health and Safety Training for Hazardous Materials Activities:Supervisors
1/18	#4309	$135	Asbestos Abatement Refresher: Facility Survey
1/18	#4313	$265	Asbestos Abatement Refresher: Facility Survey and Management Planning
1/19	#4317	$265	Asbestos Abatement Refresher: Project Management and Supervision
1/24	#4179-1	$125	Introduction to Backflow Prevention
1/24-28	#4179	$480	Backflow Prevention Technician Training and Certification
1/24-28	#4235	$875	Health and Safety Training for Hazardous Materials Activities:40-Hour OSHA course
1/25	#4236	$265	Health and Safety Training for Hazardous Materials Activities:8-Hour Refresher
FEBRUARY			
2/1-3	#4352	$695	Hydrogeology: Applications of Fundamental Concepts and Field Techniques to Florida Groundwater Investigations
2/1-3	#4105	$525	Respiratory Protection
2/7-9	#4227	$495	Landfill Design: Planning and Permitting (ORLANDO)
2/7-10	#4152-1	$1200	Fundamentals of Dispersion Modeling/Computer Modeling Laboratory
2/7-8	#4152-2	$650	Fundamentals of Dispersion Modeling
2/9-10	#4152-3	$700	Computer Modeling Laboratory
2/8-10	#4196	$445	Trouble-shooting Activated Sludge Problems in Wastewater Treatment
2/8-11	#5018-1	$425	Backflow Prevention Repair and Maintenance Training and Certification
2/9-11	#4228	$495	Landfill Design: Conceptual Design, Operations and Monitoring (ORLANDO)
2/14-16	#4306-1	$650	Asbestos Abatement: Facility Survey and Building Systems
2/17-18	#4306-2	$425	Asbestos Abatement: Management Planning
2/14-18	#4306-3	$925	Asbestos Abatement: Facility Survey and Building Systems and Management Planning
2/16	#4342	$295	Optimizing Clarifier Performance (ORLANDO)
2/17	#4341	$295	Flow Measurement (ORLANDO)
2/21-22	#4248	$95	Cross-Connection Control Conference
2/22-24	#4243	$295 ea.	How to Comply With Florida's Hazardous Waste Regulations for Generators/Hazardous Materials Transportation (TAMPA) (Both courses $545)

Date	Prog#	Fee	Title
MARCH			
3/1	#4310	$135	Asbestos Abatement Refresher: Facility Survey
3/1	#4314	$265	Asbestos Abatement Refresher: Facility Survey and Management Planning
3/1-3	#4344	$525	Complete Preventive Maintenance
3/2	#4318	$265	Asbestos Abatement Refresher: Project Management and Supervision
3/7	#4184-1	$125	Introduction to Backflow Prevention
3/7-11	#4184	$480	Backflow Prevention Technician Training and Certification
3/7-9	#4229	$595	Landfill Design: Liner System Concepts, Materials and Construction (ORLANDO)
3/8-9	#4251	$495	Hazardous Waste Management: RCRA Compliance
3/8-10	#4130	$595	Confined Space Entry Procedures
3/9-11	#4230	$595	Landfill Design: Cell and Liner System Detailed Design (ORLANDO)
3/14-15	#0000	$595	Ergonomics of Hard-Arm & Whole Body Vibration NIOSH 596 (TAMPA)
3/16-18	#0000	$695	Safety in the Laboratory NIOSH 580 (TAMPA)
3/21	#4252	$225	Refresher: Lead Abatement Training for Supervisors and Contractors
3/22-25	#4207	$750	Lead Abatement Training for Supervisors and Contractors
3/28-4/1	#4308	$825	Asbestos Abatement: Project Management and Supervision
APRIL			
4/4-8	#4237	$875	Health and Safety Training for Hazardous Materials Activities:40-Hour OSHA course
4/5	#4238	$265	Health and Safety Training for Hazardous Materials Activities:8-Hour Refresher
4/5-8	#5018-2	$425	Backflow Prevention Repair and Maintenance Training and Certification
4/4-6	#4231	$495	Landfill Design: Leachate and Gas Management Systems Design (ORLANDO)
4/6-8	#4232	$495	Landfill Design: Closure and Long-Term Care (ORLANDO)
4/11	#4126	$85/$99	Gas Chlorinator Operation and Trouble-shooting
4/12-14	#4132	$445	Chlorine Safety Technician Certification and Exam
4/12-14	#4244	$295 ea.	How to Comply With Florida's Hazardous Waste Regulations for Generators/Hazardous Materials Transportation (JACKSONVILLE) (Both courses $545)
4/18	#4193	$295	TTT for Occupational Exp. to Bloodborne Pathogens (Emergency Response)
4/19	#4192	$295	TTT for Occupational Exp. to Bloodborne Pathogens (Wastewater)
4/25-28	#4204	$595	Activated Sludge Process Control: Think Microbiologically
MAY			
5/9-13	#4345	$745	Train-the-Trainer for Environmental Health and Safety
5/10-13	#4250	$545/$225	Lead Inspector Training/Risk Assessment (Both courses $695)
5/16	#4183-1	$125	Introduction to Backflow Prevention
5/16-20	#4183	$480	Backflow Prevention Technician Training and Certification
5/18-20	#0000	$300	Solid Waste Landfill Operators Short School
5/23	#4239	$265	Health and Safety Training for Hazardous Materials Activities: Supervisors (TAMPA)
5/23	#4319	$265	Asbestos Abatement Refresher: Project Management and Supervision (ORLANDO)
5/23-25	#4245	$295 ea.	How to Comply With Florida's Hazardous Waste Regulations for Generators/Hazardous Materials Transportation (ORLANDO) (Both course $545)
5/24	#4311	$135	Asbestos Abatement Refresher: Facility Survey (ORLANDO)
5/24	#4315	$265	Asbestos Abatement Refresher: Facility Survey and Management Planning (ORLANDO)
5/23-26			1994 Environmental Resources & Compliance Conference

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Contact the specified coordinator for additional course information.
For an updated calendar or a brochure please call 904/392-9570, ext 100.

Air Quality

Understanding the Clean Air Act Amendments of 1990
Many businesses that have not been affected by the 1990 amendments soon will be. The list of hazardous air pollutants has been expanded from eight to 189. This increase requires more small businesses which were previously not covered by the law to report emissions. This seminar provides an overview of the amendments, an operating permit program, a hazardous air pollutant program and an enforcement program. CEU 0.5 [CONTACT: RICHARD ZELONKA, EXT. 122]

Fundamentals of Dispersion Modeling
Computer Modeling Laboratory (Two Courses)
In the dispersion course, students learn the basic concepts of atmospheric dispersion modeling and how they are applied to the analysis of a variety of sources. In the laboratory, students learn to perform "hands-on" dispersion modeling on a PC computer as required by the Clean Air Act, SARA Title III, state regulations or personal applications. Students are given the option of attending the fundamentals course, the computer modeling laboratory, or both for a reduced rate. CEU 1.5 per course, ABIH CEU 2.0 per course. [CONTACT: SARA WASHBURN, (904) 398-5789]

Asbestos Abatement

Under EPA Regulations, each student must be present in the classroom for the duration of the course in order to fulfill certification requirements

Asbestos Abatement: Facility Survey and Building Systems
This course has been granted full approval by EPA to meet AHERA accreditation requirements for inspectors performing asbestos work in public and private, K-12 schools. It provides hands-on and practical instruction on how to conduct asbestos surveys and inspections. Participants practice assessment and inspection techniques during an actual on-site school survey. CEU 2.1 [CONTACT - KATHY NELSON, EXT. 114]

Asbestos Abatement: Management Planning
This course has been granted full approval by EPA to meet AHERA accreditation requirements for management planners performing asbestos work in public and private, K-12 schools. Participants learn how to utilize the inspectors findings and develop a working managements plan for a facility. Detailed consideration is given to hazard assessment and selection of control options. Registrants must provide proof of having completed an EPA/AHERA-approved inspector course. CEU 1.4 [CONTACT - KATHY NELSON, EXT. 114]

Asbestos Abatement: Facility Survey & Building Systems and Management Planning
(combination of two courses & exams)
The course has been granted full approval by EPA to meet AHERA accreditation requirements for inspectors and management planners performing asbestos work in public and private, K-12 schools. The exams for individuals registered for both courses are administered the afternoon of the final day of each course (i.e., Wednesday and Friday). CEU 3.5 COMBINED ENROLLMENT IS LIMITED TO 50.
[CONTACT - KATHY NELSON, EXT. 114]

Asbestos Abatement: Project Management & Supervision
The course has been granted full approval by EPA to meet AHERA accreditation requirements for contractors/supervisors performing asbestos work in public and private, K-12 schools. It provides intensive and practical instruction on asbestos abatement projects, from start to finish. Participants tackle hands-on abatement problems in a simulated abatement area. Safe work practices, liability and glove bag procedures are examined in detail. CEU 3.5 ENROLLMENT IS LIMITED TO 40. [CONTACT - KATHY NELSON, EXT. 114]

All asbestos abatement refreshers satisfy EPA/AHERA refresher course requirements and Florida licensure reaccreditation requirements for asbestos professionals. Registrants must provide proof of having completed the initial EPA-approved training course and any subsequent refresher courses in the discipline in which they seek reaccreditation. A copy of initial and refresher certificates must be submitted with registration form.

Asbestos Abatement Refresher: Facility Survey (1/2 day)
This course reviews requirements for inspectors and updates participants on the latest EPA, OSHA, DOT and Florida Asbestos regulations. Inspection procedures are reviewed, and group exercises are used to enhance inspection techniques. Upon successful completion of the course, each participants will receive a certificate of reaccreditation as an Asbestos Inspector. CEU 0.4 [CONTACT - KATHY NELSON, EXT. 114]

Asbestos Abatement Refresher: Facility Survey & Management Planning
[Includes 1/2 day Facility Survey (inspector course) plus 1/2 day specific to Management Planning = 1 day total]
The first half of the day reviews the inspectors role in asbestos abatement, and the second half focuses on the management planner's role in asbestos hazard assessment, response actions and O&M programs. As with the facility survey portion, participants engage in group activities. Upon successful completion of the course, each participant will receive certificates of reaccreditation as both an Asbestos Inspector and Management Planner. CEU 0.75 [CONTACT - KATHY NELSON, EXT. 114]

Asbestos Abatement cont.

Asbestos Abatement Refresher: Project Management and Supervision
This course provides participants with a regulatory review and update on new asbestos legislation pertinent to asbestos contractors/supervisors. Work stations on health concerns/respiratory protection, sampling/analytical methods, liability, regulations, EPA-OSHA/AHERA, EPA-NESHAPS, and work practices and Safety provide students an opportunity to interact with their peers and course instructors. Upon successful completion of the course, each participant will receive a certificate of reaccreditation as an Asbestos Contractor/Supervisor. CEU 0.75 [CONTACT - KATHY NELSON, EXT. 114]

Asbestos Abatement 3-day Initial and 1-day Refresher Worker Courses
[CONTACT - LYNDA CHAPAPRIETA, EXT. 113]

Backflow Prevention

Introduction to Backflow Prevention
This one-day course consists of lectures and demonstrations on: backflow hazards, rules, regulations, guidelines, liabilities, responsibilities, backflow hydraulics, methods of backflow prevention and assembly standards and specifications. CEU 0.7 [CONTACT: TAMMY GUMBINER, EXT. 129]

Backflow Prevention Technician Training & Certification
This five-day course provides guidelines for acceptable practices for testing and annual inspection of backflow prevention assemblies used in cross-connection control programs. At the conclusion of the training, an individual evaluation will be administered to those who choose to participate in the Voluntary Certification program sponsored by the University of Florida and FS/AWWA. Participants will need a hand-held calculator. CEU 3.2 [CONTACT: TAMMY GUMBINER, EXT. 129]

Backflow Prevention Technician Recertification Review and Exam
Backflow Prevention Technicians, it's time to renew your TREEO-FS/AWWA approved certificates. Check the expiration date of your certificate. If it expires on December 31, 1993, you need to successfully pass an exam this fall to become recertified. Reviews and exams will be given in November and December, 1993 and January 1994. [CONTACT: TAMMY GUMBINER, EXT. 129]

Backflow Prevention Assembly Repair & Maintenance
An advanced course for certified backflow technicians, this program provides participants with hands-on experience repairing large diameter models from various manufacturers. Advanced testing procedures for RP and DC assemblies are covered. Safety procedures and precautions are stressed. CEU 2.4 [CONTACT: TAMMY GUMBINER, EXT. 129]

Groundwater

Groundwater Monitoring, Analysis and Data Interpretation*
Contamination of groundwater, one of our most valuable resources, is a widespread environmental problem. The nature and extent of the problem is usually assessed through a groundwater sampling and analysis program that must be implemented with care. In this course, responsible parties, consulting engineers, professional geologists, regulatory authorities and laboratory personnel who are involved in the assessment of the problem learn the processes that lead to meaningful data and the methods that can be used to interpret the data. CEU 1.2 [CONTACT: STEPHANIE WEST, EXT. 116]

Hydrogeology: Applications of Fundamental Concepts and Field Techniques to Florida Groundwater Investigations*
The increasing concern about protection, management and utilization of groundwater has created the need for people with an understanding of the hydrogeology of Florida. This course addresses the demand by providing basic groundwater concepts with applications in the field. Fundamental conceptual and analytical groundwater concerns are presented. Field techniques are applied to demonstrate various hydrogeologic models common in Florida and to solve several typical problems. The emphasis is on Florida hydrogeology. (Enrollment limited to 35). CEU 2.0 [CONTACT: STEPHANIE WEST, EXT. 116]

****Approved by the Florida Solid Waste Management Training Committee to satisfy Chapter 17-703 continuing education requirements for maintaining Landfill Operator Certification in Florida.***

Groundwater cont.

Introduction to Groundwater: Contamination, Investigation and Remediation Assessment*
This course provides introductory training in the movement of contaminants throughout groundwater systems. Instruction includes technical and management approaches for controlling groundwater quality. Participants learn basic concepts in hydrogeology, how the aquifer functions, principles of chemical contaminant transport and groundwater modeling and monitoring. Remedial activity case studies, including successes and failures, also are covered. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 116]

Introduction to Groundwater Modeling: Using Microcomputers to Solve Groundwater Problems
This course introduces the use of computer models to solve groundwater problems. Topics to be covered include one-dimensional flow to canals, radial flow to wells, contaminant plume models and injection wells, and pathline and travel-time determinations. Students receive hands-on experience with microcomputers in laboratory sessions. Potential applications include predicting dewatering effects of canals and mining operations, determining pumping effects due to wellfields, and analyzing contaminant transport in groundwater from landfills and other contaminant sources. (Enrollment limited to 22). CEU 1.6 [CONTACT: STEPHANIE WEST, EXT. 116]

Hazardous Materials/Waste

How to Comply With Florida's Hazardous Waste Regulations for Generators
This course teaches participants about the latest requirements of the Resource and Recovery Act (RCRA). Students learn how to comply with the regulations and the proper procedure for the accumulation, storage, transportation, and disposal of hazardous waste. Procedures for developing a contingency plan and how to comply with the DOT regulations that relate to hazardous waste are explained. Specifically addressed are regulatory requirements for waste characterization, container marking and labeling, manifesting, transportation, emergency response and disposal. Waste reduction is discussed. CEU 0.7 [CONTACT: SARA WASHBURN, (904) 398-5789]

** Approved by the Florida Solid Waste Management Training Committee to satisfy Chapter 17-703 continuing education requirements for maintaining Landfill Operator Certification in Florida.*

Hazardous Materials Transportation: Understanding the New Requirements
This course reviews the new requirements under Docket HM-181 "Performance-oriented Packaging Standards" for hazardous materials transportation. Students learn how to use the hazardous materials regulations and the hazardous materials table. The required information for shipping papers and the requirements and restrictions for marking, labeling and placarding are covered. A Hazardous Materials Transportation Specialist from the U.S. Department of Transportation, Florida Office of Motor Carriers will be present to answer pertinent questions. CEU 0.6 [CONTACT: SARA WASHBURN (904) 398-5789]

Hazardous Waste Management: RCRA Compliance
This course explains the RCRA law to operators and provides a forum for participants to receive answers to their most pressing questions. RCRA experts offer to participants their legal, regulatory and technical expertise. Regulators share the theory and the practical applications of working in Florida and Region IV of the Environmental Protection Agency to manage hazardous waste treatment, storage and disposal; to prevent the creation of hazardous waste; and to close regulated treatment, storage and disposal units.
CEU 1.4 [CONTACT: SARA WASHBURN, (904) 398-5789]

Planning and Training for Regulatory Compliance*
In this course, participants gain a better understanding of each agency's regulatory requirements. They can then use this knowledge to determine the needs of their company and plan the appropriate training. CEU 0.6 [CONTACT: RICHARD ZELONKA, EXT. 122]

Train-the-Trainer For Environmental Health & Safety*
This course provides instruction in both the design and delivery of environmental courses that are required to have training under AHERA, EPA, OSHA and DOT regulations. Instructors are provided with the tools required to make this required training a successful experience. CEU 2.8 [CONTACT: RICHARD ZELONKA, EXT. 122]

Storage Tank Operations Management
This course is designed for personnel who install, maintain, clean, enclose or remove underground or aboveground storage tanks. Participants learn skills and knowledge necessary to perform their jobs safely and efficiently. In addition, they learn the regulations and guidelines for controlling the physical and chemical hazards they may incur. CEU 1.8 [CONTACT: RICHARD ZELONKA, EXT. 122]

Health and Safety

Hazardous Materials: Chemical Behavior and Terminology For Supervisors and Workers*
This course is for those whose job responsibilities include the knowledge of different types of hazardous materials. Participants learn about the chemistry of hazardous materials and how to identify different classes commonly encountered in the work place. Hazard communication laws are addressed, and participants learn how to comply with environmental regulations under RCRA and the Occupational Safety & Health Administration. CEU 0.6 [CONTACT: RAMONA BRYANT, EXT. 120]

Practical Considerations For Hazardous Materials Incidents
This course is designed for coordinators implementing a command system at an incident and implementing an emergency response plan. Topics to be covered include risks and hazards associated with employees working in chemical protective clothing; local, state, regional, and federal emergency response plans; and decontamination procedures. CEU 1.6 [CONTACT: RAMONA BRYANT, EXT. 120]

Emergency Response Operations: 24-Hour
This course provides attendees with the knowledge and information they need to respond safely to incidents involving hazardous substances. State-of-the-art technology and techniques will provide a firm foundation for those who are required to respond to an incident involving hazardous substances. Practical demonstrations are used to show students how the knowledge they learn in the classroom works in the field. CEU 2.4 [CONTACT: RAMONA BRYANT, EXT. 120]

How to Comply With OSHA Regulations
In this course, participants are introduced to the OSHA standards with particular emphasis on the most frequently cited violations. Among the topics to be covered are: the OSHA act; Recordkeeping; Inspections, Citations and Proposed Penalties; and Hazard Communication. CEU 3.0 [CONTACT: RAMONA BRYANT, EXT. 120]

****Approved by the Florida Solid Waste Management Training Committee to satisfy Chapter 17-703 continuing education requirements for maintaining Landfill Operator Certification in Florida.***

Health and Safety Training For Hazardous Materials Activities: 40-Hour OSHA Compliance Course
This course provides 40 hours of intensive classroom instruction and hands-on training fulfilling OSHA requirements (29 CFR 1910.120[e][3][i]) as mandated under the "Superfund Amendments and Reauthorization Act of 1986" (SARA). Specific guidance for compliance with RCRA, CERCLA and OSHA regulations that affect design and implementation of site operating safety, contingency plans and training is emphasized. CEU 4.0 [CONTACT: RAMONA BRYANT, EXT. 120]

Health and Safety Training For Hazardous Materials Activities: 8-Hour Refresher
This course satisfies OSHA annual refresher training requirements under 29 CFR 1910.120[e][8] in the areas of protective equipment; respirator use; safety; and health and hazards on a site. It includes an overview of the regulations and basics of effective supervision and maintenance of a site. Also covered are record keeping and logs; site maintenance and housekeeping; site entry and control procedures; handling site accidents and emergencies; complying with other OSHA requirements and working with regulatory personnel. CEU 0.8 [CONTACT: RAMONA BRYANT, EXT. 120]

Health and Safety Training For Hazardous Materials Activities: Supervisors
This course is designed specifically to meet the OSHA requirements (29 CFR 1910.120[e][4]) that on-site managers and supervisors at regulated hazardous waste operations and long-term spill clean-ups receive eight hours of specialized training in the management of such operations. CEU 0.8 [CONTACT: RAMONA BRYANT, EXT. 120]

Confined Space Entry Procedures*
Facilities containing confined space are now required to have written permit program. This course covers the OSHA Permit Required Confined Space regulation (29 CFR 1910.146). The course will be especially helpful for business owners and managers who review safety plans; federal, state and local government personnel; environmental compliance officers; emergency response personnel; and manufacturers. CEU 2.0 [CONTACT: RAMONA BRYANT, EXT. 120]

Chlorine Handling and Containment
In this course, participants learn and practice safe chlorine handling techniques during normal use and emergencies. Emphasis is on chemical properties of chlorine. The program features hands-on practice in the repair of a simulated leak. CEU 0.6 [CONTACT: TAMMY GUMBINER, EXT. 129]

Health and Safety cont.

Chlorine Safety Technician Training and Certification
This course provides instruction and hands-on practice for chlorine emergency response. It satisfies the 24-hour requirement under the Occupational Safety and Health Administration standard 29 CFR 1910.120, that individuals receive training before responding to incidents involving hazardous substances. Participants have the opportunity to diagnose practical problems and to plan and implement remedial actions. Sessions include instruction and practice in basic maintenance, use of airpacks and emergency kits A & B. (Limited enrollment) CEU 2.4 [CONTACT: TAMMY GUMBINER, EXT. 129]

Respiratory Protection
According to the OSHA requirement 29 CFR 1910.134, there must be a respiratory protection program in all facilities that contain employees wearing respirators. This three-day course covers the OSHA requirements for the establishment, maintenance and monitoring of a respiratory protection program. Participants are given examples of written standard operating procedures, the first element of an effective respiratory protection program. Respirator selection, cleaning, maintenance and storage are covered, and qualitative and quantitative fit testing is demonstrated. CEU 2.4 [CONTACT: KATHY NELSON, EXT. 114]

Toxicology and Risk Assessment
This first day of this two-day course includes lectures on the concepts and principles of toxicology. Instructors discuss specific classes of chemical induced toxicities. Day two is a workshop on the scientific basis and mechanisms of assessing risk. In the risk assessment workshop, instructors concentrate on the practical aspects of designing, completing and submitting a risk assessment to regulatory agencies. Although the option exists for students to take one or both days, students will benefit most by completing both the toxicology and risk assessment sections. CEU 1.6 [CONTACT: SARA WASHBURN, 904/398-5789]

Ergonomics of Hard-Arm and Whole Body Vibration NIOSH 569
In this class, you will learn how to recognize, measure, evaluate, and control the excessive levels of vibration exposure in manufacturing equipment. Learn how to reduce the health and safety problems to fellow employees, avoid crippling injuries, support and improve employee relations, create an environment that meets OSHA standards, and reduce company out-of-pocket costs associated with poor internal safety standards. CEU 1.4, ABIH CEU 2.0 [CONTACT: SARA WASHBURN, 904/398-5789]

Safety in the Laboratory NIOSH 580
This course prepares laboratory workers and supervisors, industrial hygienists and safety professionals to recognize, evaluate and control the hazards in the laboratory. The OSHA laboratory standard CFR 1910.1450 will be discussed as well as the OSHA HazCom Standard. You will also learn about chemical and physical hazards. Compressed gases, emergency care, fire protection, housekeeping and personnel protecting equipment procedures are covered. CEU 2.1, ABIH CEU 3.0 [CONTACT: SARA WASHBURN, 904/398-5789]

Sampling and Evaluating Airborne Asbestos Dust NIOSH 582
The focus of this course is NIOSH Analytical Method #7400. You will learn the sampling equipment operation and calibration, proper sampling procedures, and data collection and analysis. CEU 3.2, ABIH CEU 5.0 [CONTACT: SARA WASHBURN, 904/398-5789]

Train-the-Trainer For Occupational Exposure to Bloodborne Pathogens
This course educates those affected by the OSHA Bloodborne Pathogens standard (29 CFR 1910.130) on the proper procedures for preventing exposure and provides individuals with the tools necessary to train their employees on bloodborne pathogens. Wastewater treatment personnel and emergency response personnel are encouraged to attend. CEU 0.8 [CONTACT: PEGGY LATNER, EXT. 111]

Public Information: Packaging Your Message For the Media
Organizations must project a clear message to the public when addressing a controversial issue. Managers, company representatives and supervisors must learn how to respond to the media to guarantee public support. In this course, participants learn how to respond to the different types of media in an interview and how to structure responses to favorably influence the public's reception of the message. CEU 0.8 [CONTACT: SARA WASHBURN 904/398-5789]

A Standard Operating Procedure Plan For Phase I Environmental Site Assessments
Since the performance of Phase I Environmental Site Assessments (ESAs) is not currently regulated, the Florida Environmental Assessors Association (FEAA) has generated a Phase I ESA Standard of Performance (SOP) specific to the State of Florida. Approved by the National Registry of Environmental Professionals, this program focuses on the SOP and a wide variety of other relevant related national and Florida specific issues. All program attendees must apply for and successfully complete an examination for certification from FEAA, TREEO and NREP. The exam fee is included in the course fee. CEU 1.0 [CONTACT: RICHARD ZELONKA, EXT. 122]

Lead Abatement

Lead Inspector Training
Risk Assessment (Two courses)
The first course utilizes the EPA Model curriculum to train participants how to determine lead in paint, soil, dust and other areas using advanced testing methods and inspection techniques. The second course discusses risk assessment management issues specific to public housing. CEU 2.8, ABIH CEU 4.0 [CONTACT: SARA WASHBURN, (904) 398-5789]

Lead Abatement Training for Supervisors and Contractors
This program assists contractors, consultants, facility managers and regulators in responding to problems involving the identification and abatement of lead-based paints. Instructors focus on the newly revised Department of Housing and Urban Development (HUD) guidelines and provide participants with hands-on experience with practical situations. CEU 3.2, ABIH CEU 4.0 [CONTACT: SARA WASHBURN, (904) 398-5789]

Refresher: Lead Abatement Training for Supervisors and Contractors
This refresher course addresses recent regulatory changes concerning lead abatement issues including the 1992 OSHA Lead in Construction Standard, abatement techniques, and other developments. #4252, $225 [CONTACT: SARA WASHBURN, (904) 398-5789]

Maintenance

Complete Preventive Maintenance: Using New Technologies*
This seminar provides a thorough introduction to modern preventive maintenance concepts and techniques. It focuses on the various stages of program implementation, with emphasis on the important first steps in planning a practical preventive maintenance program. Program implementation and evaluation are discussed, and participants learn to monitor systems to prevent costly and time consuming malfunctions. Personnel objectives and the role of computers in preventive maintenance are emphasized. CEU 1.3 [CONTACT: RICHARD ZELONKA, EXT. 122]

** Approved by the Florida Solid Waste Management Training Committee to satisfy Chapter 17-703 continuing education requirements for maintaining Landfill Operator Certification in Florida.*

An Introduction to Electrical Maintenance
This introductory course provides basic information about electricity and how it works. Participants will learn how to read wiring diagrams and practice assembling control circuits. CEU 2.1 [CONTACT: PEGGY LATNER, EXT. 111]

Mechanical Maintenance
This three-day workshop provides plant operators with hands-on experience assembling water and wastewater equipment. Instructors also explain how to trouble-shoot common equipment problems. Participants are encouraged to bring problem equipment to use in trouble-shooting exercises, as well as plant drawings to use with blueprint readings. Water and wastewater plant operators, collection/distribution field technicians, maintenance personnel, plumbers, and those responsible for the maintenance of a water and wastewater system should attend this course. CEU 2.4 [CONTACT: PEGGY LATNER, EXT. 111]

Solid Waste

Solid Waste Operators Short School
This DER-approved course satisfies training requirements under 17-703 FAC for those seeking accreditation as landfill operators. Participants have one year of work experience in landfill operations, a high school diploma or two years experience at a class I, II or III landfill and pass the course exam to be certified by DER. CEU 2.0 [CONTACT: RICHARD ZELONKA, EXT. 122]

Landfill Design: Planning and Permitting*
This course enables students to conduct preliminary studies; select the cost effective solid waste management alternative; describe the characteristics of MSW; conduct a waste characterization study; evaluate waste reduction alternatives; develop a municipal solid waste management facility permit; secure all necessary permits; implement the procedures necessary to secure public support and site the landfill; and apply value analysis planning techniques to solid waste management decision making. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 116]

Landfill Design: Conceptual Design, Operations and Monitoring*
This course teaches participants how to develop a conceptual design for the landfill system; specify all ancillary components; develop a landfill operations plan; devise and specify an effective landfill monitoring system; and plan and detail systems for handling special wastes. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 116]

Solid Waste cont.

Landfill Design: Liner System Concepts, Materials and Construction*
This course covers landfill liner system options; the function of each component in the liner system; characteristics of soil and geosynthetic liner materials; how each material is used; select the best material to meet landfill performance and design standards; laboratory and field testing procedures; interpret test results and written specifications; and implement an effective QA/QC for liner system construction and installation. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 122]

Landfill Design: Cell and Liner System Detailed Design*
This course prepares participants to describe landfill cell components with emphasis on their design and operations; delineate the geotechnical issues that must be considered; design a stable landfill cell; design the leachate control system; fashion and specify a landfill stormwater management system; and prepare an operations plan for the system. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 122]

Landfill Design: Leachate and Gas Management Systems Design*
This course prepares the student to explain the factors that affect leachate and gas generation; estimate leachate quantity and quality; design leachate collection, treatment and disposal systems; understand gas generation and migration; estimate the quantity and quality of gas produced; and specify gas vent, collection, recovery and use systems. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 116]

Landfill Design: Closure and Long-Term Care*
This course enables the participant to delineate landfill closure requirements; design a stable final cover system; evaluate end-use options; and develop a long-term care plan for the closed landfill. CEU 1.3 [CONTACT: STEPHANIE WEST, EXT. 116]

Advanced Course For Recycling Professionals: Commercial/Institutional Recycling
The Florida Center for Solid and Hazardous Waste Management recently conducted a survey and found a need for advanced recycling training of city and county recycling coordinators and private recycling. This course these individuals improve their strategies for meeting recycling goals as mandated by the Solid Waste Management Act. Topics discussed include identifying and tapping into existing markets; understanding material specifications and their role in establishing stable markets; establishing new uses for and marketing non-traditional materials; and reducing materials loss in the recycling program. CEU 1.6 [CONTACT: PEGGY LATNER EXT. 111]

Stormwater Management

EPA Stormwater Management Model Version 4.2 (SWMM4) Workshop
This course has been designed so that users (or potential users) of EPA's Storm Water Management Model Version 4.2 (SWMM4) receive the training they need to effectively use the model. The theoretical and numerical basis for model computations is presented, and participants are able to practice with demonstration problems and case studies on a microcomputer. CEU 2.0 [CONTACT: PEGGY LATNER, EXT. 111]

****Approved by the Florida Solid Waste Management Training Committee to satisfy Chapter 17-703 continuing education requirements for maintaining Landfill Operator Certification in Florida.***

Water and Wastewater Quality

Activated Sludge Process Control: Think Microbiologically
In this course, participants receive an overview of the complex biological processes in an activated sludge system. They learn how to monitor and control the process for the benefit of microorganisms and maintain efficient operations. This course is especially appropriate for anyone interested in the identification of microorganisms and filaments. CEU 2.1 [CONTACT: PEGGY LATNER, EXT. 111]

Trouble-shooting Activated Sludge Problems in Wastewater Treatment
This course helps operators to identify, evaluate, and solve operational difficulties before they become serious. Data, tests and calculations used for process monitoring and troubleshooting are explained. Each student has the opportunity to apply the evaluation process in detailed, realistic examples. The EPA Expert System developed to evaluate treatment processes will be demonstrated. CEU 2.1 [CONTACT: PEGGY LATNER, EXT. 111]

Performing Energy Audits of Water Quality Systems
This course instructs students on how to perform an energy audit and how to evaluate the pumps and motors in their facilities by collecting electrical data using various test equipment. In addition, they learn how to maintain motors for maximum efficiency and life. The benefits of good maintenance programs relative to energy conservation are stressed. Participants are encouraged to bring hand-held calculators to class. CEU 1.4 [CONTACT: JIM CLIFTON, EXT. 130]

Water and Wastewater Quality cont.

Principles of Utility Management and Supervision
Personnel Management (Two courses)
This week long course is the first part of a certificate program to be developed by the University of Florida TREEO Center. The core of the certification program, these two courses cover facility management skills, methods of organization and control, personnel recruitment skills and personnel supervisory skills. Participants can enroll in the full week or take individual courses. This course is beneficial to individuals wishing to fulfill training requirements for the Florida Department of Professional Regulation's Class A water and wastewater certification examination. CEU 1.8 for each course [CONTACT: PEGGY LATNER, EXT. 111]

Gas Chlorinator Operation and Trouble-shooting
This half-day course is essential to provide a residual disinfection for water supply systems. If you are an operator or manager of a public water supply system, a utility superintendent or just someone interested in this topic, this course is for you. You receive specialized training dismantling and trouble-shooting of all major brands of chlorinators and extensive explanation about how the gas flows through a cylinder. Participants are welcome to bring in chlorinators for specific questions on repair or maintenance. CEU 0.6 [CONTACT: TAMMY GUMBINER, EXT. 129]

Optimizing Clarifier Performance
Flow Measurement (Two courses)
The first course presents comprehensive coverage of current clarifier design, operation and maintenance considerations, and the second focuses on the full range of flow measurement topics from basic principles to determining hard-to-measure flow streams at existing plants. Both classes utilize a unique combination of classroom lectures and field activities. [CONTACT: RICHARD ZELONKA, EXT. 122]

Cross-Connection Control Program Manager Certification Program
The University of Florida TREEO Center is now offering a Program Manager Certificate to individuals who successfully complete the following three courses: *Introduction to Backflow Prevention* (or *Backflow Prevention Technician Training & Certification*), *Cross-Connection Control: Survey and Inspection* and *Cross-Connection Control: Ordinance and Organization*. The program is designed for cross-connection control supervisors or for those persons who will soon become supervisors, this program assists individuals in the administration of a cost effective cross-connection control program. For more information about the courses, contact Tammy Gumbiner, ext. 129.

Cross-Connection Control Conference
This conference will address current issues in cross-connection control and backflow prevention. Experts in the field will be available to discuss pertinent issues. Participants are encouraged to bring questions on specific problems for discussion. Manufacturers will be displaying the latest products and services. Administrators, utility and public works directors, and attorneys are strongly urged to attend. Lunch will be provided the first day. [CONTACT: TAMMY GUMBINER 904/392-9570, EXT. 129]

Cross-Connection Control: Supervisors
This one-day workshop for supervisors focuses on changes in state regulations in cross-connection control and backflow prevention. Representatives from various state regulatory agencies such as DEP, HRS and DNR will be on-hand to discuss participants' questions. Administrators and supervisors of water utility companies are encouraged to attend. [CONTACT: TAMMY GUMBINER 904/392-9570, EXT. 129]

Cross-Connection Control: Survey and Inspection
In this two-day course, participants learn to identify appropriate methods to prevent backflows for isolation and containment; review new construction plans to eliminate cross-connections; and conduct a field survey demonstrating how to inspect for cross-connections. Those participants who successfully complete the voluntary exam will be certified Cross-Connection Control Inspectors by TREEO. It is recommended that participants first complete Introduction to Backflow Prevention, Backflow Prevention Technician Training. CEU 1.8 [CONTACT: TAMMY GUMBINER, EXT. 129]

Cross-Connection Control: Ordinance and Organization
In this course, participants learn the essentials of developing and managing an effective cross-connection control program. Topics to be discussed include: legal authority; policies; budget preparation; recordkeeping; training and education; assembly standards and specification; the elements of a good ordinance; and liabilities and responsibilities. It is recommended that participants first attend Introduction to Backflow Prevention (or Backflow Prevention Technician Training) and the Survey and Inspection course. CEU 1.2 [CONTACT: TAMMY GUMBINER, EXT. 129]

UNIVERSITY OF FLORIDA

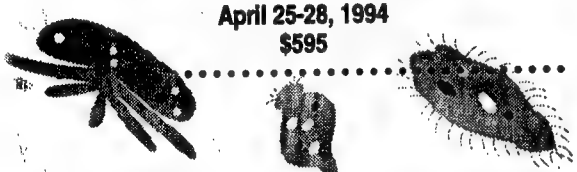
TREEO CENTER

Presents

Two courses to make wastewater systems more efficient

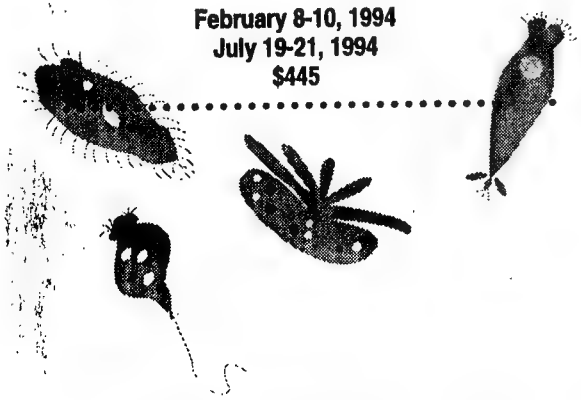
Activated Sludge Process Control: Think Microbiologically

November 15-18, 1993
April 25-28, 1994
$595



Trouble-shooting Activated Sludge Problems in Wastewater Treatment

February 8-10, 1994
July 19-21, 1994
$445



Activated Sludge Process Control: Think Microbiologically

About the Course

In this course, participants receive an overview of the complex biological processes in an activated sludge system. They learn how to identify microorganisms and filaments and how to monitor and control the processes for the benefit of the microorganisms.

In addition to the course manual, each participant receives three publications that address various aspects of the activated sludge control process. They are designed to enhance the participants' awareness of microbiology, the causes and control of activated sludge bulking and foaming, and operating activated sludge using oxygen uptake.

Filament staining techniques are demonstrated, and participants are given the opportunity to observe actual slides under microscopes. Participants are encouraged to bring in sludge samples in transfer bulbs for analysis and their phase contrast microscopes.

Topics

Day One

- Process Variations and Overview
- Basic Activated Sludge Microbiology
- Oxygen Uptake Rate and Demonstration

Day Two

- Microscopic Observation
- Microscope Basics and Floc Characterization
- Sludge Mass Determination
- Sludge Unit Concepts
- Protozoa and Metazoa

Day Three

- Protozoa and Metazoa Identification Lab
- Filamentous Microorganisms
- Filament Identification Lab

Day Four

- Nitrification/Denitrification, Step Feed
- Pressures and Process Control Plan

Trouble-shooting Activated Sludge Problems in Wastewater Treatment

About the Course

This course helps operators to identify operational difficulties before they become serious and to evaluate treatment processes to maintain a smooth-running system. Data, tests and calculations used for process monitoring and trouble-shooting are explained. Each participant has the opportunity to apply the evaluation process in detailed, realistic examples. The EPA Expert System developed to evaluate the treatment process is demonstrated. Participants also receive a demonstration of a computer spreadsheet that manages and calculates process control data.

Topics

Day One

- Activated Sludge Operating Modes
- Process Control Tests
- Activated Sludge Process Control Methods

Day Two

- Activated Sludge Process Control Methods
- Introduction to Trouble-shooting
- Industrial Waste and Sewer-Use Ordinances
- Solids Handling
- Chemical Addition
- Nutrient Removal
- Trouble-shooting Problems

Day Three

- Trouble-shooting Problems
- Review and Test
- Tour of an Advanced Wastewater Treatment Plant

Meet Your Instructor(s)

Activated Sludge

RONALD G. SCHUYLER, PE, DEE, is a senior project manager for Rothberg Tamburini and Winsor, a consulting engineering firm in Denver, CO. Schuyler brings his educational credentials, practical experience and several years of teaching to the classroom. He has more than 23 years experience in various water quality positions, beginning his work career in 1970 as a district engineer for the Colorado Water Quality Control Division. Schuyler has taught biological wastewater process control to operators and engineers for more than 18 years. He is a registered Professional Engineer, a diplomate in the American Academy of Environmental Engineers and a certified water and wastewater treatment plant operator. Schuyler has a Master of Science degree in microbiology.

Schuyler is an active member of the WEF, Rocky Mountain WPCA and the Personnel Advancement Committee. He is past Federation Plant Operations Chairman and was RMWPCA president in 1986.

Trouble-shooting

JOSEPH CHEATHAM is serving his 24th year with Gainesville Regional Utilities and is manager of the Water Reclamation Division. He has been active in wastewater operations issues at local, state and national levels. Cheatham is chairman of the Professional Wastewater Operation Division Management Committee and serves on the Water Environment Federation Ad-Hoc Committee on Operation Professionals. Cheatham is affiliated with the Water Environment Federation (WEF), Professional Wastewater Operation Division, Florida Pollution Control Association and the Florida Water Pollution Control Operator Association.

JAMES CLIFTON is the assistant director of technical services at the University of Florida TREEO Center. Clifton is a NETA-Certified Environmental Trainer with a specialty in wastewater. He has taught courses in energy conservation, activated sludge process control and trouble-shooting, electrical maintenance and chlorine safety. Clifton has co-authored two technical manuals on energy use in water quality systems and has written manuals on wastewater plant operations, chlorine safety and several other correspondence courses. Clifton has both a Bachelor's and Master's degree in Biology from Edinboro State University of Pennsylvania.

J. CLAY SYKES is project development manager for Operations Management International, Inc., which contract-operates over 80 water and wastewater treatment facilities nationwide. Sykes worked for over seven years as process design engineer with CH^2M Hill in Gainesville, FL and Montgomery, AL. He has designed numerous wastewater treatment facilities and specializes in the areas of nutrient removal, aeration system design, effluent reuse and sludge treatment. Sykes is a registered professional engineer, and has both a Bachelor's and Master's degree in Civil Engineering from Mississippi State University.

GENERAL INFORMATION

Registration

Registration begins at 8:00 a.m. on the first day and the course begins at 8:30 a.m. The fee is $595 for the **Activated Sludge** course and $445 for the **Trouble-shooting** course. For registration information call Susan Swilley at (904) 392-9570, ext. 112. For course information, call Peggy Latner at ext. 111.

Course Location

All courses will be held at:
UF/TREEO Center
3900 S.W. 63rd Blvd.
Gainesville, FL 32608-3848
904/392-9570

Hotel Accommodations

Participants are responsible for arranging their own accommodations. Special room rates have been blocked at the hotels listed. Identify yourself as a participant of one of these UF/TREEO courses to receive the special rates. The room block will be released two weeks before each course.

Cabot Lodge, 3726 S.W. 40th Blvd. (I-75 & SR 24), Gainesville, FL 32608, 904/375-2400, 1-800-843-8735, $41 Single $45 Double.

Holiday Inn West, 7417 N.W. 8th Ave. (I-75 & SR 26), Gainesville, FL 32607, 1-800-426-4287, ext. 295, $39 Single, $43 Double

To Register

There are three quick ways to register:

By Phone: (Visa or MasterCard Registrations Only) Call 904/392-9570, ext. 112.

By Fax: Send completed registration form, including credit card and social security numbers to 904/392-6910, 24 hours.

By Mail: Return registration form with payment by check, Visa or MasterCard to the address listed at the bottom of the form.

REGISTRATION WILL BE CONSIDERED COMPLETE ONLY UPON RECEIPT OF BOTH REGISTRATION FORM AND PAYMENT IN U.S. DOLLARS. ALL REMITTANCES SHOULD BE MADE PAYABLE TO THE UNIVERSITY OF FLORIDA.

Cancellation Policy

If you cannot attend, written notification must be received at least two working days prior to the course. You may either transfer to another class (transfer credit good for only 1 year), send a substitute, or receive a refund. In the event that a course is cancelled, UF/TREEO is not responsible for non-refundable travel fares or lodging deposits.

Certificate and Accreditation

Those who attend and complete the activated sludge course will be awarded 2.4 Continuing Education Units (CEUs) and a certificate of attendance. Those who attend and complete the trouble-shooting course will be awarded 2.0 Continuing Education Units (CEUs) and a certificate of attendance.

OPERATION OF WASTEWATER TREATMENT PLANTS

Volume I

A Field Study Training Program

• ENVIRONMENTAL PROTECTION AGENCY •
• OFFICE OF WATER PROGRAMS •
• DIVISION OF MANPOWER AND TRAINING •

OPERATION OF WASTEWATER TREATMENT PLANTS

Third Edition

VOLUME I

A Field Study Training Program

prepared by

California State University, Sacramento
(formerly Sacramento State College)
Department of Civil Engineering

in cooperation with the
California Water Pollution Control Association

****

Kenneth D. Kerri, Project Director
Bill B. Dendy, Co-Director
John Brady, Consultant and Co-Director
William Crooks, Consultant

****

for the

Environmental Protection Agency
Office of Water Program Operations
Municipal Permits and Operations Division
First Edition, Technical Training Grant No. 5TT1-WP-16-03 (1970)
Second Edition, Grant No. T900690010

1986

OPERATOR TRAINING MANUALS IN THIS SERIES available from Ken Kerri, California State University Sacramento, 6000 J Street, Sacramento, CA 95819, phone 916-278-6142.

1. **Operation and Maintenance of Wastewater Collection Systems,**
2. **Treatment of Wastewater from Electroplating, Metal Finishing and Printed Circuit Board Manufacturing,**
3. **Water Supply System Operation,** 1 Volume, and
4. **Water Treatment Plant Operation,** 2 Volumes.

NOTICE

This manual is revised and updated before each printing based on comments from persons using the manual.

FIRST EDITION

First printing, 1971	5,000
Second printing, 1972	7,000
Third printing, 1973	9,000
Fourth printing, 1974	6,000
Fifth printing, 1975	4,000
Sixth printing, 1977	11,000
Seventh printing, 1979	4,000

SECOND EDITION

First printing, 1980	7,000
Second printing, 1982	8,000

THIRD EDITION

First printing, 1985	8,000
Second printing, 1986	8,000

PREFACE TO THE FIRST EDITION

The purposes of this home study program are:

a. to develop qualified treatment plant operators;
b. to expand the abilities of existing operators, permitting better service to both their employers and the public; and
c. to prepare operators for *CERTIFICATION EXAMINATIONS*.[1]

To provide you with information needed to operate wastewater treatment plants as efficiently as possible, experienced plant operators prepared the material on treatment plant processes. Each chapter begins with an introduction and then discusses start up, daily operation, interpretation of lab results and possible approaches to solving operational problems. This order of topics was determined during the testing program on the basis of operators' comments indicating the information they needed most urgently. Additional chapters discuss maintenance, safety, sampling, laboratory procedures, hydraulics, records, analysis and presentation of data, and report writing.

Plant influents (raw wastewater) and the efficiencies of treatment processes vary from plant to plant and from location to location. The material contained in this program is presented to provide you with an understanding of the basic operational aspects of your plant and with information to help you analyze and solve operational problems. This information will help you operate your plant as efficiently as possible.

Wastewater treatment is a rapidly advancing field. To keep pace with scientific advances, the material in this program must be periodically revised and updated. This means that you, the operator, must recognize the need to be aware of new advances and the need for continuous training beyond this program.

Originally the concepts for this manual evolved from Mr. Larry Trumbull, 1967 Chairman of the Operator Training Committee of the California Water Pollution Control Association. Messrs. Bill Dendy and Kenneth Kerri, Project Directors, investigated possible means of financial support to develop and test the manual and prepared a successful application to the Federal Water Pollution Control Administration (5TT1-WP-16-03). The chapters were written, tested by pilot groups of operators and potential operators, reviewed by consultants and the Federal Water Quality Administration, and rewritten in accordance with the suggestions from these sources.

The project directors are indebted to the many operators and other persons who contributed to the manual. Every effort was made to acknowledge material from the many excellent references in the wastewater treatment field. Special thanks are due Messrs. John Brady and William Crooks who both contributed immensely to the manual. Mr. F.J. Ludzack, Chemist, National Training Center, Environmental Protection Agency, Water Quality Office, offered many technical improvements. A note of thanks is also due our typists, Miss Linda Smith, Mrs. Gloria Uri, Mrs. Daryl Rasmussen, Mrs. Vicki Sadlem, Mrs. Peggy Courtney, and Mrs. Pris Jernigan. Illustrations were drawn by Mr. Martin Garrity.

Following the first year of use by over 6500 operators and persons interested in operation, minor editing changes were necessary to correct typing errors and omissions and also to rewrite and expand questions and sections that could be clarified. Improvements suggested by operators using the manual were summarized and forwarded to a special Technical Advisory Task Force composed of operators familiar with the manual. This Task Force was formed as a subcommittee of the Water Pollution Control Federation's Personnel Advancement Committee and was chaired by Mr. Sam Warrington. We gratefully thank John Brady, Carlos Doyle, Otto Havens, Wilbur Holst, William Johnson, F.J. Ludzack and David Vandersommen for their efforts to improve our original version.

Kenneth D. Kerri
Bill Dendy

1973

[1] *Certification examination. An examination administered by a state or professional association that operators take to indicate a level of professional competence. In most states the Chief Operator of a plant must be "certified" (successfully pass a certification examination), and in a few states certification is voluntary. Current trends indicate that certification of operators will be mandatory in all states in the near future.*

PREFACE TO THE SECOND EDITION

During the 1970's many people decided that something must be done to control water pollution. The United States Congress passed the "Federal Water Pollution Control Act Amendments of 1972" (PL 92-500) and subsequent amendments. The objective of this Act is to restore and maintain the quality of the Nation's waters. In order to achieve this objective, the Act contains provisions for a financial grant program to assist municipalities with the planning, construction, start up and training of personnel in publicly-owned wastewater treatment plants. Grant funds have been used to build many new plants to date and many more plants will be built in the future. These plants are becoming more complex and are requiring operators with higher levels of knowledge and skills in order to insure that the plants produce a high quality effluent.

This manual, *OPERATION OF WASTEWATER TREATMENT PLANTS*, was used by over 40,000 persons interested in the operation of treatment plants during the 1970's. Every year when more manuals were printed, the manual was updated on the basis of comments and suggestions provided by persons using the manual. After six years of use by operators, the authors, the California Water Pollution Control Association, and the U.S. Environmental Protection Agency (EPA) decided that the contents of the manual should be reexamined, updated and revised. To accomplish this task, EPA provided the Foundation of California State University, Sacramento, with a grant to conduct the necessary studies, writing and field tests.

Recently the U.S. Environmental Protection Agency and the Association of Boards of Certification (ABC) have undertaken studies to document "need to know" tasks performed by wastewater treatment plant operators, skills required, alternative methods of training, training material needs and availability, and the development of instructional materials for certification examinations. Every effort has been made to incorporate the results of these studies in this Second Edition of *OPERATION OF WASTEWATER TREATMENT PLANTS*.

The project directors are indebted to the many operators and other persons who contributed to the Second Edition. Material from the many excellent references in the wastewater treatment field has been acknowledged wherever possible. Joe Bahnick, Ken Hay, Adelaide Lilly, Frank Lapensee and Bob Rose, U.S. Environmental Protection Agency, served ably as resource persons, consultants and advisers. Special thanks are due our project consultants, Mike Mulbarger, Carl Nagel and Al Petrasek who provided technical advice. Our education reviewers were George Gardner and Larry Hannah. Christine Umeda and Marlene Itagaki administered the national field testing program. A note of thanks was well earned by our typists Charlene Arora, Elaine Saika and Gladys Kornweibel. Illustrations were drawn by Martin Garrity.

Kenneth D. Kerri
John Brady

1980

USES OF THIS MANUAL

Originally this manual was developed to serve as a home-study course for operators in remote areas or persons unable to attend formal classes either due to shift work, personal reasons or the unavailability of suitable classes. This home-study training program used the concepts of self-paced instruction where you are your own instructor and work at your own speed. In order to certify that a person had successfully completed this program, an objective test was included at the end of each chapter and the training course became a correspondence or self-study type of program.

Once operators started using this manual for home study, they realized that it could serve effectively as a text-book in the classroom. Many colleges and universities have used the manual as a text in formal classes often taught by operators. In areas where colleges were not available or were unable to offer classes in the operation of wastewater treatment plants, operators and utility agencies joined together to offer their own courses using the manual.

Occasionally a utility agency has enrolled from three to over 300 of its operators in this training program. A manual is purchased for each operator. A senior operator or a group of operators are designated as instructors. These operators help answer questions when the persons in the training program have questions or need assistance. The instructors grade the objective tests at the end of each chapter, record scores and notify California State University, Sacramento, of the scores when a person successfully completes this program. This approach avoids the long wait while papers are being graded and returned by CSUS.

This manual was prepared to help operators run their treatment plants. Please feel free to use it in the manner which best fits your training needs and the needs of other operators. We will be happy to work with you to assist you in developing your training program. Please feel free to contact

Ken Kerri, Project Director
Operation of Wastewater Treatment Plants
California State University, Sacramento
6000 Jay Street
Sacramento, California 95819

Phone (916) 278-6142
or 278-6366

INSTRUCTIONS TO PARTICIPANTS IN HOME-STUDY COURSE

Procedures for reading the lessons and answering the questions are contained in this section.

To progress steadily through this program, you should establish a regular study schedule. For example, many operators in the past have set aside two hours during two evenings a week for study.

The study material is contained in three volumes divided into 29 chapters. Some chapters are longer and more difficult than others. For this reason, many of the chapters are divided into two or more lessons. The time

required to complete a lesson will depend on your background and experience. Some people might require an hour to complete a lesson and some might require three hours; but that is perfectly all right. *THE IMPORTANT THING IS THAT YOU UNDERSTAND THE MATERIAL IN THE LESSON!*

Each lesson is arranged for you to read a short section, write the answers to the questions at the end of the section, check your answers against suggested answers; and then *YOU* decide if you understand the material sufficiently to continue or whether you should read the section again. You will find that this procedure is slower than reading a normal textbook, but you will remember much more when you have finished the lesson.

At the end of each chapter, you will find an "objective test." Mark your answers on the special answer sheet provided for each chapter. Some discussion and review questions are provided following each lesson in the later chapters. These questions review the important points you have covered in the lesson.

The objective test at the end of each lesson contains true or false, multiple-choice, fill-in-the-blank, or match-the-answers types of questions. The purposes of this exam are to review the chapter and to give experience in taking different types of exams. *MAIL TO THE PROGRAM DIRECTOR ONLY YOUR ANSWERS TO OBJECTIVE TESTS ON THE PROVIDED ANSWER SHEETS.*

After you have completed the last objective test, you will find a final examination. This exam is provided for you to review how well you remembered the material. You may wish to review the entire manual before you take the final exam. Some of the questions are essay-type questions which are used by some states for higher-level certification examinations. After you have completed the final examination, grade your own paper and determine the areas in which you might need additional review before your next examination.

You are your own teacher in this program. You could merely look up the suggested answers from the answer sheet or copy them from someone else, but you would not understand the material. Consequently, you would not be able to apply the material to the operation of your plant nor recall it during an examination for certification or a civil service position.

YOU WILL GET OUT OF THIS PROGRAM WHAT YOU PUT INTO IT.

SUMMARY OF PROCEDURE

A. OPERATOR (YOU)

1. Read what you are expected to learn in each chapter (from Chapter 4 on, the major topics are listed at the beginning of the chapter).
2. Read sections in lesson.
3. Write answers to questions at end of sections in your notebook. You should write the answers to the questions just like you would if these were questions on a test.
4. Check your answers with suggested answers.
5. Decide whether to reread section or to continue with the next section.
6. Write answers to discussion and review questions at the end of lessons in your notebook.
7. Mark answers to objective test on answer sheet.
8. Mail material to project director.

Ken Kerri, Project Director
Operation of Wastewater Treatment Plants
California State University, Sacramento
6000 Jay Street
Sacramento, California 95819

B. PROJECT DIRECTOR

1. Mails answer sheet for each chapter to operator.
2. Corrects tests, answers any questions, and returns results to operators.

C. ORDER OF WORKING LESSONS

To complete this program you will have to work all of the chapters. You may proceed in numerical order, or you may wish to work some lessons sooner. The Arithmetic Appendix, "How to Solve Wastewater Treatment Plant Arithmetic Problems," may be worked before Chapter 4 because Chapter 4 requires the use of simple arithmetic. If you have trouble with the problems in chapter 4 or some of the following chapters, you may find it helpful to refer to the arithmetic appendix or you may decide to work the arithmetic appendix first.

Chapter 16, "Laboratory Procedures and Chemistry," in Volume II may be studied with Chapter 5 because the operation of sedimentation and flotation treatment processes requires some laboratory tests. Again, you may wish to refer to the lab chapter while working on Chapter 5 and the other chapters, or you may wish to work the lab chapter first.

SAFETY IS A VERY IMPORTANT TOPIC. Everyone working in a treatment plant must always be safety conscious. You must take extreme care with your personal hygiene to prevent the spread of disease to yourself and your family. Operators in treatment plants daily encounter situations and equipment that can cause a serious disabling injury or illness if the operator is not aware of the potential danger and does not exercise adequate precautions. For these reasons, you may decide to work on the chapter on "Plant Safety and Good Housekeeping" early in your studies. In each chapter *SAFE PROCEDURES ARE ALWAYS STRESSED.*

COURSE OUTLINE
VOLUME I, THIRD EDITION

TECHNICAL CONSULTANTS, FIRST EDITION

William Garber
George Gardner
Carl Nagel
Joe Nagano
Frank Phillips
Warren Prentice
Ralph Stowell
Larry Trumbull

TECHNICAL CONSULTANTS, SECOND EDITION

George Gardner
Larry Hannah
Mike Mulbarger
Carl Nagel
Al Petrasek

COURSE OUTLINE

VOLUME II, SECOND EDITION

VOLUME III, SECOND EDITION

APPENDIX B
EXAMPLE LABORATORY RECORDS, DATA SHEETS

BIOCHEMICAL OXYGEN DEMAND
STANDARD METHODS 18th EDITION, PAGE 5-2
PROCEDURE 5210B

SAMPLE/ DATE	VOLUME (ml) SAMPLE	VOLUME (ml) SEED	INITIAL			FINAL			D.O. DROP	BOD^5 (mg/l)
			#	D.O.	DATE	#	D.O.	DATE		

G/AT663CTS/PM4/MAC/030392

FECAL COLIFORM
STANDARD METHODS, 18th EDITION, PAGE 9-60
MEMBRANE FILTER PROCEDURE 9222D

SAMPLE/ DATE	ML SAMPLE	PLATE COUNT	DILUTION FACTOR	NO./100ML	DATE/TIME SET UP	DATE/TIME READ	ANALYST

pH
STANDARD METHODS, 18th EDITION, PAGE 4-65
PROCEDURE 4500-H^+B

SAMPLE/ DATE	ZERO METER	BUFFER CHECK VALUE/READING/TEMP	DATE	SAMPLE READING/TEMP	ANALYST

G/AT663CTS/PM4/MAC/030392

SUSPENDED SOLIDS
STANDARD METHODS, 18th EDITION
(TOTAL SUSPENDED SOLIDS, PAGE 2-56, PROCEDURE 2540 D)
(VOLATILE AND FIXED SOLIDS, PAGE 2-57, PROCEDURE 2540E)

Sample					
Sample Date					
Sample Volume (ml)					
Dish No.					
Dish Residue Wt. (R)					
Dish Ignited Residue Wt. (I)					
Dish Wt. (T)					
Solids (grams) R-T					
Volatile Solids (grams) R-I					
Solids (mg/l)					
Volatile Solids (mg/l)					
Analyst/Date					

Sample					
Sample Date					
Sample Volume (ml)					
Dish No.					
Dish Residue Wt. (R)					
Dish Ignited Residue Wt. (I)					
Dish Wt. (T)					
Solids (grams) R-T					
Volatile Solids (grams) R-I					
Solids (mg/l)					
Volatile Solids (mg/l)					
Analyst/Date					

Sample					
Sample Date					
Sample Volume (ml)					
Dish No.					
Dish Residue Wt. (R)					
Dish Ignited Residue Wt. (I)					
Dish Wt. (T)					
Solids (grams) R-T					
Volatile Solids (grams) R-I					
Solids (mg/l)					
Volatile Solids (mg/l)					
Analyst/Date					

TOTAL SOLIDS

STANDARD METHODS, 18th EDITION

(TOTAL SOLIDS DRIED AT 103-105°C, PAGE 2-54, PROCEDURE 2540 B)

(VOLATILE AND FIXED SOLIDS IGNITED AT 550°C, PAGE 2-57, PROCEDURE 2540E)

Sample					
Sample Date					
Sample Volume (ml)					
Dish No.					
Weight of Dried Residue + Dish, mg (A)					
Weight of Dish & residue After Ignition, mg (B)					
Weight of Dish, mg (C)					
Total Solids, mg/l $= \frac{(A-C) \times 1000}{\text{Sample Volume, ml}}$					
Volatile Solids, mg/l $= \frac{(A-B) \times 1000}{\text{Sample Volume, ml}}$					

Sample					
Sample Date					
Sample Volume (ml)					
Dish No.					
Weight of Dried Residue + Dish, mg (A)					
Weight of Dish & residue After Ignition, mg (B)					
Weight of Dish, mg (C)					
Total Solids, mg/l $= \frac{(A-C) \times 1000}{\text{Sample Volume, ml}}$					
Volatile Solids, mg/l $= \frac{(A-B) \times 1000}{\text{Sample Volume, ml}}$					

Sample					
Sample Date					
Sample Volume (ml)					
Dish No.					
Weight of Dried Residue + Dish, mg (A)					
Weight of Dish & residue After Ignition, mg (B)					
Weight of Dish, mg (C)					
Total Solids, mg/l $= \frac{(A-C) \times 1000}{\text{Sample Volume, ml}}$					
Volatile Solids, mg/l $= \frac{(A-B) \times 1000}{\text{Sample Volume, ml}}$					

CHLORINE RESIDUAL SAMPLE

DATE COLLECTED	TIME ANALYZED	TYPE OF SAMPLE	Cl_2 PPM	LOCATION OF SAMPLE	INITIALS OF ANALYST

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BOD_5 INCUBATOR RECORD

DATE READ	TIME READ	INCUBATOR TEMPERATURE O°C	INITIALS OF ANALYST	REMARKS

DRYING OVEN RECORD

DATE READ	TIME READ	TEMP. OF OVEN O°C	INITIAL OF ANALYST	FILTER DRYING START TIME	FILTER DRYING FINISH TIME	SAMPLE DRYING START TIME	SAMPLE DRYING FINISH TIME

LAB REFRIGERATOR RECORD

TEMP. OF REFRIGERATOR

DATE READ	TIME READ	TEMP. OF REFRIGERATOR	INITIALS OF ANALYST	REMARKS

DILUTION WATER INCUBATION RECORD

DATE READ	TIME READ	INCUBATOR TEMPERATURE 0°C	INITIALS OF ANALYST	REMARKS

COMPOSITE SAMPLE RECORD

DATE COL-LECTED	BOTTLE NO.	TIME COL-LECTED	LOCATION OF SAMPLE	PARSHALL FLUME		MGD	% ERROR	FLOW METER READING	CHART RE-CORDER READING	COM-POSITE SAMPLE ML	SAMPLERS INITIALS
				INCH	FT.						

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